The Effect of
Biological Treatment on Behavior and Communication of
Children on the Autistic Spectrum

Thesis submitted for the degree of
Doctor of Philosophy
At the University of Natural Medicine, Santa Fe

by

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May, 2006

Acknowledgements

I would like to thank all the people who assisted me in this difficult and complicated project. First and foremost I thank and I appreciate the 9 families of the Autistic and PDD children, who cooperated, received my counseling and took my advice. I know how difficult it was. The beneficial changes most of them brought to their children's lives had an important influence on me. It was frustrating not to get cooperation from the rest of the families, and only because of the ones who did implement the program, I had the energy to continue and believe in what I do.

I thank Annette Kahan, PhD. for all her assistance, wise feedback and expert comments.

I thank Dr. Adiel Tel-Oren, for his support and useful comments and ideas.

I also thank my family, who had to put up with a very busy and tired mother all this time…and especially my son Eshed, who helped me so much with the computer, the charts and all the technical part of writing…

And last but not least, my husband Ohn, who supported me throughout the process. Without his love and patience I would have never completed this project.

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Abstract

This preliminary study has emerged from the need to find the reasons and the solutions to the "Autistic epidemic". Once rare (1:10,000 before 1980), Autism Spectrum Disorders (ASD) have increased by 2003 to 1:250 and more recently even higher. Research on Autism and ADHD suggests that these conditions may relate to abnormal byproducts of yeast and drug-resistant bacteria which are absorbed into the body from the intestine following the excessive use of antibiotics given for ear infection (Shaw, 1998, 2003). Another possible explanation is the immunizations with mercury-containing preservative (Thimerosal) (Yazbak, 2003).

Literature review reveals that there is a growing body of knowledge regarding the biochemical and biological reasons for the symptoms of ASD, and new effective biological treatment approaches are discussed. The purpose of this study was to determine whether a change in biological factors as measured by the Organic Acid Test in urine (OAT), developed by Dr. Shaw, could lead to a change in the behavior and the development of children on the spectrum. The main reason for this study was the optimistic outlook as to the possibility of prevention of developmental disorders in children, by eliminating allergens and poisons, by introducing wholesome nutrition, and by utilizing some nutritional supplements.

Twenty children with neuro-behavioral disorders took the OAT and filled out parents' and teachers' questionnaires. Only nine of these twenty children followed through with the treatment program including changes in diet (gluten and casein free diet, free of chemicals and additives) and supplementation (vitamins and minerals, DHA-EPA, etc., according to the OAT results). All of the nine children were rated again by their parents, showing remarkable improvement in behavior, communication and attention in a relatively short time. A case study methodology was used in this research, and limitations and implications for further research are discussed.

Chapter 1

Introduction – or why did I choose this subject?

Since 1973, I have been working as an Occupational Therapist (OT) with children with developmental delays, hyperactivity, learning disabilities and attention disorders. As a young student I became familiar with the Autistic syndrome while working in a mental hospital near Jerusalem. I was terribly touched by these tragic children, who were institutionalized for life, neglected by their families and abused by other mental patients. These all seemed like chronic, helpless situations, and we, the OT's, were working with them, stimulating them, trying to get some eye contact or communication, through movement, touch and games, but with very little progress. It was very frustrating, and I also felt that I was not working with the REAL person, since they were highly medicated. For this reason I chose to work with healthier children, the ADHD's, where I could see more hope and faster results. I used the Sensory Integration Approach, and Learning through Movement, and I saw very nice improvement and progress in their learning and motor skills. However, there was something missing.

I studied for 3 years in the Educational Psychology and Rehabilitation Counseling Department of the University of Wisconsin, Milwaukee, and got my Masters degree. During that time (1978-1981) I discovered the area of biofeedback, self- regulation and stress management. This became my main interest, and I specialized in psychophysiology, implementing the relationships between body and mind into my therapeutic skills. I worked with children as well as with adults, teaching them how to relax and cope better with stress, how to self-control, and how to live a life of wellness. And still, there was something missing.

I recognized similar histories of these children over the years. Many of them were not breast fed, or nursed just for a short time. Many of them developed normally until they received the required vaccines and then responded with high fever, followed by developmental regression and delay, frequent ear infections, asthma and/or other problems with breathing, frequent use of antibiotics, slow motor development, sleep disorders, hyperactivity and restlessness, problems with bowel movement, headaches and/or stomach aches. In addition, I noted that these children were eating large quantities of sugar, junk food, and refined, artificial or processed foods. It should also

be noted that there was a significant increase in the number of children suffering from ADHD and Autistic spectrum, a raise that was called epidemic statistically, and it seemed that no one was interested in the causes and possible prevention (Yazbak, 2003).

Over the years I read Dr. Feingold's (1975) book about diet and hyperactivity, Dr. Rapp's (1991) book on allergies and children with ADHD, Dr. Stordy's (2000) book on the LCP Solution for ADHD, dyslexia and dyspraxia, Dr. Shaw's (1998) and Dr. Rimland's work (1998), and other great books that supported my intuition about the relationship between nutritional or other biological factors and behavior and development. I began guiding the parents regarding a more natural approach, such as eliminating dairy products and choosing wholesome natural foods instead of artificial drinks and processed foods. Some of my clients took it seriously and the change in behavior was remarkable. However, since they were in therapy, learning to control their impulsive behavior through biofeedback, relaxation and self-regulation methods, we could not tell if the improvement in symptoms was due to the therapy or due to the change in diet, or both. It may have been a combination of parental guidance and cooperation, a more natural diet, and the biofeedback techniques that they have learned to use during our sessions.

Two years ago, the Functional and Dental Health Foundation (M.R.P.I) was established in Israel, opening a whole new world of knowledge, and physiological-biochemical lab tests that had not existed in Israel could now be carried out. I was excited by the fact that perhaps now, after so many years of frustration and numerous attempts trying to persuade parents and doctors that biological factors **do** relate to behavioral and developmental disorders, we could study these relationships here in Israel, and hopefully get more awareness and support from professionals towards prevention.

The problem and the purpose of the study

There has been a significant increase in the number of children suffering from the Autism spectrum disorders over the past decades. Once rare (1;10,000), Autism has grown to 1:250 (Yazbak, 2003), and more recently even higher. Research on Autism and ADHD suggests that these conditions may relate to abnormal byproducts of yeast

and drug-resistant bacteria, which are absorbed into the body from the intestine following the excessive use of antibiotics given for ear infection (Shaw, 1998).

Oral antibiotics have been used increasingly in the last 60 years, and it is possible that this is a major contributing factor in the increased incidence of Autism and other developmental disorders such as ADD/ADHD (Hagerman & Falkenstein, 1987). One of the main reasons for antibiotic use is for treatment of otitis media (ear infections). The use of antibiotics in children, as well as in the commercial poultry and cattle industry, has promoted the growth of intestinal yeast, fungi and antibiotic-resistant bacteria (Roberts, et al, 1994). In animal agriculture, these micro-organisms produce chemical toxins that are absorbed into the blood stream of the animals, which are then eaten as meat by humans. In the human intestine these toxins may cause "leaky gut syndrome" which allows peptides (such as casein and gluten) to enter the blood stream and then the brain (Shaw, 1998).

Hyperactivity and attention deficits are also related to food additives, food allergies, and sucrose, as well as poisoning of heavy metals (Feingold, 1975; Rapp, 1980; Rimland, 1998).

Recent years have seen the publication of a body of scientific research supporting the effectiveness of elimination diets, most commonly targeting artificial food colors and preservatives, cow's milk, wheat, and soy, for ADD and hyperactivity.

Controlled human experiments investigating the consequences of ingestion of food dyes by hyperactive children have yielded evidence of adverse effects on learning (Swanson, 1980) and behavior (Rowe, 1994). A number of well-designed double-blind, placebo controlled trials have demonstrated the effectiveness of dietary elimination for the control of behavioral symptoms in hyperactivity and ADD (Egger, 1985; Kaplan et al., 1989; Carter et al., 1993; Boris, 1994). The percentage of ADD or hyperactive children who improve on an open elimination diet varies among these reports from 58% (Kaplan, 1989) to 82% (Egger, 1985). The percentage of subjects whose food-induced behavioral symptoms are confirmed by double-blind placebo-controlled food challenges ranges from 60% (Carter et al., 1993) to 75% (Egger, 1985).

New studies (Geier, 2003) suggest that there is also a link between Thimerosal-containing vaccines (MMR) and neuro-developmental disorders, such as regressive Autism. Not enough attention is being paid to this serious epidemic and its present and future impact (Yazbak, 2003). More studies should be conducted in order to

determine all causes involved in these developmental disorders, so they can be prevented.

The purpose of this study was to determine whether a change in biological factors as measured by the Organic Acid Test developed by Dr. Shaw (described below) could lead to a change in the behavior and the development of children on the spectrum. The main reason for this study is the optimistic outlook as to the possibility of **prevention of developmental disorders in children**, by eliminating allergens and poisons, and by introducing wholesome nutrition and indicated nutritional supplements.

Chapter 2

LITERATURE REVIEW

Introduction

The spectrum of Neuro-Behavioral Disorders

The following is the neuro-behavioral disorders spectrum as described by the Autism Research Institute (major disorders) (California Dept. of Developmental Services, 2003):

ADD/ADHD	Dyslexia	Asperger's	Hyperlexia	PDD	Autism
Less severe		more severe			Most severe

If the symptoms are mild, a child may be diagnosed with Attention Deficit Disorder (with or without Hyperactivity). Moderate symptoms might result in a diagnosis of Asperger's Syndrome. If severe, the diagnosis would be PDD or autism (as seen on the neuro-behavioral spectrum). The Autistic Spectrum of Disorders includes: ADD/ADHD, Angelman's, dyslexia, Asperger's, hyperlexia, dyspraxia, Klinefelter's, Landau-Kleffner, obsessive-compulsive disorder (OCD), Rett's, Tourette's, childhood disintegration disorders, PDD (Pervasive developmental Disorder) and Autism (California Dept. of Developmental Services, 2003). These diagnoses share many of the neurological, behavioral and physiological symptoms, and they were arranged in this order according to the severity of these symptoms. For example -Asperger's disorder is also called a high-functioning Autism.

ADD/ADHD – the less severe condition will be described below, as well as the most severe condition – autism. In between, as seen above, there are other neuro-behavioral disorders, that will not be discussed in this paper. All these disorders have in common the problems with attention and behavior. They have neurological symptoms, as well as psychological and developmental symptoms, which emanate from nervous system dysfunction but react upon the surroundings and influence the person's relationships, communication and learning.

Since there are many similarities and overlapping symptoms among the neuro-behavioral disorders, this research touches only the 2 extremes of the spectrum: The first part of the literature review will deal with the **ADD/ADHD** syndrome (diagnosis, conventional approach versus holistic/biological approach, and research in this area), and the second part will deal with **Autism** (diagnosis, conventional approach versus holistic/biological approach, and research in this area).

A. What is ADD/ADHD?

ADD stands for Attention Deficit Disorder; ADHD - for Attention Deficit Hyperactive Disorder. Most professionals see ADD/ADHD as one of the most serious problems in children (Green & Chee, 1994). It was first described in 1902 by the British pediatrician George Frederic Still, who believed it was either biologically inherited or due to injury at birth. Over the years, a variety of labels have been attached to children with the condition, including "minimal brain dysfunction", "hyperkinetic reaction of childhood", and "hyperactive child syndrome". The term "Attention Deficit Disorder" became widely used in the 1980s. Today, the official name is Attention Deficit/Hyperactivity Disorder (ADHD) (Stordy and Nicholl, 2000).[1]

2-5% of the children have ADHD, which is a neurological biological problem characterized by a mild dysfunction or imbalance of neurotransmitters in the brain (noradrenalin and dopamine). This imbalance is located in the brain areas that are responsible for self-impulse-control and it can be seen in PET and MRI scans in the frontal lobes (Green and Chee, 1994; Barkley, 1995). Several studies have shown that people with ADHD have lower levels of electrical activity and decreased blood flow in the frontal brain lobes, compared to non-ADHD adults and children. The frontal lobes control concentration, attention span, organization, judgment and impulses – all faculties that are impaired in ADHD. These parts of the brain are using less glucose,

[1] When the ADHD term is discussed in general throughout this paper, it includes all types, except from the discussion of each type separately.

get less oxygen and have a lower blood flow in children with ADHD (Stordy and Nicholl, 2000).

Other studies using MRI have discovered that children with ADHD have slightly smaller right brains than that in non-ADHD children, a finding that coincides with the fact that the right cerebral hemisphere is responsible for self control (Sears & Thompson, 1998).

In conclusion, there are biological differences in the brains of individuals with ADHD. These are not children who choose to be lazy or disruptive, and they are not the product of poor parenting. They are individuals whose brains function differently. For this reason Sears and Thompson (1998) prefer calling ADD - Attention Developmental Difference.

a. Diagnosing ADD/ADHD

In general, this disorder is characterized by poor memory and low achievement at school, impulsive hyperactive behavior, and lack of control in children with normal or above-normal intelligence (Sears and Thompson, 1998).

The American Psychiatric Association reference book, the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) (2000) is responsible for the latest labeling. Its main categories of ADHD are:

1. Predominantly inattentive.
2. Predominantly hyperactive-impulsive.
3. A combination of the two.

According to the DSM, a diagnosis of **ADHD/inattentive type** can be made if 6 or more of the following symptoms have been displayed for at least six months:

1. Failing to pay attention to details or making careless mistakes in schoolwork or other activities.
2. Difficulty sustaining attention in tasks or play activities.
3. Not seeming to listen when spoken to directly.
4. Not following through on instructions and failing to finish schoolwork or chores.

5. Difficulty organizing tasks or activities.
6. Avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework).
7. Loses things such as toys, school assignments, pencils, books, and tools.
8. Easily distracted by extraneous stimuli.
9. Forgetful in daily activities.

A diagnosis of **ADHD/hyperactivity-impulsivity** can be made if six or more of the following symptoms have often been displayed for at least six months:

Hyperactivity

1. Fidgets with hands or feet or squirms in seat.
2. Leaves seat in classroom or other settings in which remaining seated is expected.
3. Runs about or climbs excessively in inappropriate situations.
4. Difficulty playing or engaging in leisure activities quietly.
5. "On the go" or acts as if "driven by a motor".
6. Talks excessively.

Impulsivity

7. Blurts out answers before questions have been completed.
8. Has difficulty awaiting turns.
9. Interrupts or intrudes on others by, for example, butting into conversations or games.

A diagnosis of **ADHD/combined type** can be made if six (or more) symptoms of inattention and six (or more) symptoms of hyperactivity/impulsivity have persisted for at least six months. Most children with ADHD have the combined type.
{In this paper two assessment tools were used, which assess all three components in a modified way – the Conners' scale (Sears and Thompson, 1998), and Barkley's Attention scale (Barkley, 1995) (see Appendix 4 and 5).

Green and Chee (1994) do not believe that there is a connection between nutrition and ADHD. They state that there may be children who respond to certain ingredients in the food (natural or unnatural) and that this may make the problem worse, but it is not

the cause. They feel that ADHD is a definite genetic disorder, which runs in families, mostly from the paternal side. As the child grows older, the behavioral problems, the hyperactivity, restlessness and impulsivity diminish in most cases, but the inattention and learning difficulties continue to be a problem through adulthood.

Most of the children with ADHD are diagnosed after age 6 or 7, when the difficulties at school arise. Before school age, demands on the children are less, so most of them manage without treatment. However, in some cases where children display hyperactivity and unexpectedly strong tantrums, coupled with a low frustration threshold and aggression towards other children, it is possible to make a diagnosis at the early age of 3 or 4. In many cases the adults in a child's environment react negatively to his/her behavior, thus enhancing the problem by creating a cycle of low self-esteem-resentment and social problems (Barkley, 1995).

Half of ADHD children suffer from specific learning disabilities. Language or arithmetic problems are not caused by ADHD but they are related to it (Stordy and Nicholl, 2000). Dyslexia (difficulties in language and reading) is also a genetic problem that has been found to coincide with ADHD in many cases.

The inattention and the hyperactive behaviors interfere with organization, concentration, and the ability to start a task and finish it successfully. Short-term memory problem interferes with the ability to understand long texts, etc. (Barkley, 1995).

There are children that have only ADD without hyperactivity. These are quiet and slow, unorganized, inattentive, like dreamers, and their academic achievements are low. They are usually diagnosed only after age 10, where you can still succeed at school with no motivation, and since they are quiet, they don't disturb anyone and they can be missed (Green & Chee, 1994).

Regardless of the categories defined for ADHD, it remains an elusive and difficult disorder to diagnose. These children may experience academic underachievement, difficulty in interacting with family and peers, and behavioral problems such as aggression and impulsiveness. No specific medical laboratory markers exist for ADHD, and the diagnosis is usually based on behavioral assessment tests, observations from parents and teachers, and clinical assessments from healthcare providers.

The extreme variations in diagnosing "true" ADHD patterns was shown in a recent study performed by researchers (LeFever,1999) at the Center for Pediatric Research at

Eastern Virginia Medical School in Norfolk who evaluated the extent of ADHD medication use. Students enrolled in grades two through five in the school districts in two cities (5,767 students in city A and 23,967 students in city B) were evaluated based on nurse records of those receiving ADHD medication in school. The prevalence of ADHD was 12 percent in district (city) A and 63 percent in district (city) B. The researchers concluded that the criteria for ADHD diagnosis vary substantially across U.S. populations, with potential over-diagnosis and over-treatment of ADHD in some groups of children.

b. Common medical treatment - Ritalin

Due to lack of control, the ADHD children get in trouble in many cases. They get involved in accidents, they tend to fall and behave inappropriately in social situations (Green and Chee, 1994). Many of the children with ADHD are impulsive, and act before they think and then they get frustrated since they are not satisfied of the outcome. Behavioral treatment does not work well with these children, and the most common treatment for ADHD is stimulants. The medications help the child to concentrate and listen and get better results at school. Ritalin and other medications (amphetamines) have been in use for more than 40 years. Green and Chee (1994) and Barkley (1995) state that, 80-90% of the ADHD children benefit from the stimulants at least for short term. They state that there could be some minor side effects, but they emphasize their safety in general, and how dangerous it can be if the child is not treated, due to accidents, not to mention the difficulties in relationships or failure at school, leading to poor self-esteem and self-image.

Ritalin (methylphenidate), and two other drugs, Dexedrin (dextroamphetamine) and Cylert (pemoline), have been approved by the Food and Drug Administration (FDA). The standard dose of Ritalin takes about 2 hours to reach maximum efficacy, and it becomes ineffective after about 4 hours. Several extended release tablets, which take about 4-5 hours to reach peak rate and remain effective for about 8 hours, have recently been approved by FDA (Stordy, 2000). These drugs are stimulants, chemically related to amphetamines, but for reasons that are not fully understood, this paradox works, and they enable the child to calm down, focus on a task and reduce hyperactivity.

Over the past 20 years, amid reports of an explosion of new cases of ADHD, production of methylphenidate (Ritalin) and amphetamines has increased almost six fold. While advocates see the expanded use of these stimulants as an appropriate response to a legitimate medical condition, critics argue that they are prescribed inappropriately to children whose behaviors fail to satisfy adult expectations, but do not conform to strict diagnostic criteria (Stordy, 2003; Armstrong, 1997).

Professionals who treat children with ADHD, hyperactivity, and related disorders should of course be aware of the advantages of stimulant medicines. It is incumbent upon them also to understand the limitations and risks of these controlled substances, even when given to children accurately diagnosed with ADD, and to maintain familiarity with the considerable scientific literature supporting a range of effective non-stimulant medical strategies, including, for example, diet restriction and allergy treatment.

c. Effects of Stimulant Treatment in ADD/ADHD

A U.S. DEA (Drug Enforcement Administration) report (Nov.1999) states that more than 10% of school-age children have been diagnosed with either ADD or ADHD. In some schools as many as 20% of the students are medicated each day. Prescriptions for methylphenidate (Ritalin) have increased more than 600% in just 10 years! At the current rate, more than 8 million school children in the USA are now on the drug, while sales are more than 1 billion dollar a year. America uses 5 times more Ritalin than all other countries combined. The DEA is heavily involved in Ritalin use because it is a powerful stimulant and has quickly become a sought-after street drug. While it can have a calming effect on younger children with ADHD, in older individuals it acts as a stimulant or form of “speed,” which the DEA warns has the same properties as cocaine and is highly addictive. According to a DEA study (1998), 16% of the children on Ritalin reported that they had been approached to sell their medication and 4% reported having it stolen at least once.

Brookhaven National Laboratory researchers (www.bnl.gov) have been following 5000 children with ADHD from childhood into adulthood. Based on their findings, it appears that when Ritalin-treated ADHD children reach adolescence, they exhibit higher rates of alcohol and drug abuse, and the Ritalin users are involved in more criminal activities and accidents, as compared to non-users of Ritalin. More than a third of these individuals drop out of the school system, exhibit depression, higher rates of divorce, low self-esteem, and one tenth attempt suicide (Swanson, 1993). Swanson and his co-authors (1993), in a comprehensive literature review, indicate that the proven advantages of stimulant medications (Ritalin and the amphetamines) for patients with ADHD are modest. Accumulated evidence reveals that, when they work, stimulants produce only temporary improvement in over-activity, inattention, impulsivity, deportment, aggression, social interactions, and academic productivity. Adverse drug effects, such as increasing tics and problems with eating, sleeping, cognition, and mood, must be weighed against these limited benefits. In most cases, stimulant treatment is stopped within two years. Stimulants do not improve reading or other skills, and ameliorate neither long-term academic achievement nor eventual social functioning.

Cylert (pemoline), another drug used to treat ADHD in children and adults, is being withdrawn in Canada due to possibility of serious liver complications, according to Abbot Laboratories (Anthony, 1999).

In conclusion, although stimulant-treatment seems to help temporarily with some of the problems of ADHD children, the negative consequences of its use are serious, and an alternative approach will be discussed further in this review.

d. ADD/ADHD – A different Approach - Non-stimulant Medical Strategies

As mentioned above, there are three separate types of ADD/ADHD:

1. ADD with hyperactivity- ADHD (hyperactive/impulsive type).
2. ADD without hyperactivity (inattentive type).
3. The combined type (or ADD, the residual type).

The first two disorders will be discussed separately. The discussion of **hyperactivity** is concerned largely with the role of **food additives, food allergies and sucrose**, while the discussion of **attention deficit disorder without hyperactivity** focuses on **heavy metals and ear infections**. Residual attention deficit disorder (individuals are 18 years or older) is viewed primarily as a continuation of the process of ADD into adulthood (Anthony, 1997).

1. ADD with Hyperactivity -ADHD

The following are the characteristics of this disorder (as described above), now cited in order of frequency (Stordy and Nicholl, 2000):

1. Hyperactivity (an inability to sit still for any length of time, even at mealtime, sleep disturbances, head-knocking, disturbing other children, self destructive behavior).
2. Perceptual motor impairment.
3. Emotional instability (mood swings, temper tantrums, low tolerance for stress, a tendency to become frustrated easily).
4. General coordination deficit (clumsiness).
5. Disorders of attention (short attention span, absentmindedness, distractibility, lack of perseverance, failure to finish things, not listening, poor concentration).
6. Impulsiveness (action before thought, abrupt shifts in activity, poor organizing, jumping in class, impatience, difficulty waiting).
7. Disorders of memory and thinking (forgetfulness, difficulty solving problems or managing time).
8. Specific learning disabilities.
9. Disorders of speech and hearing.
10. Equivocal neurological signs and EEG irregularities.

Not all symptoms are present in any one individual. Hyperactivity may be characterized by one symptom or a combination of the above symptoms (Stordy and Nicholl, 2000).

These characteristics are frequently associated with difficulties in school, both in learning and behavior. Although other factors may be involved in the etiology (cause) considerable evidence points toward:

a. food additives

b. sucrose (sugar) consumption
c. food sensitivities, as being responsible for the majority of hyperactivity in the USA (Feingold, 1975, 1982; Rapp, 1991).

a. Food additives

The term "food additives" covers a large range of chemicals, such as anti-caking agents (calcium silicate), antioxidants (BHT, BHA), bleaching agents (benzoyl peroxide), colorings, flavorings, emulsifiers, mineral salts, preservatives (benzoates), thickeners, vegetable gums, etc. It is now estimated that each person in the USA consumes 8-10 pounds of food additives each year (Anthony, 1997). The theory that food additives induce hyperactivity is commonly referred to as the "Feingold hypothesis" (Feingold, 1975). According to Feingold, many hyperactive children – perhaps 40-50 percent – are sensitive to artificial food colors, flavors, and preservatives, and to naturally occurring salicylates and phenolic compounds. His claims are based on his experience with over 1200 cases in which food additives were linked to learning and behavior disorders. The role of food additives in hyperactivity has been debated in the scientific literature (Conners, 1976, 1978; Rowe, 1979, 1984; Swanson, 1980). However, researchers have focused on only ten food dyes, versus the thousands of food additives with which Dr. Feingold was concerned.

While searching the literature, it appears that the majority of the double-blind studies designed to test the Feingold hypothesis have shown essentially negative results. That is, they found no link between food additives and hyperactivity. However, upon closer examination of these studies and further investigation into the literature, it becomes evident that food additives do, in fact, play a major role in hyperactivity (Rowe, 1984, Rimland, 1983). This is somewhat in opposition to the final report, filed by the National Advisory Committee on Hyperkinesis and Food Additives to the USA Nutrition Foundation in 1980. However, the U.S National Institutes of Health, Consensus Conference on Defined Diets and Childhood Hyperactivity, agreed to reconsider the Feingold diet in the amelioration of hyperkinesis (Lipton, et al. 1983). The reason for this reconsideration is largely due to the overwhelming evidence produced in several studies, and the fact that despite major inadequacies in negative studies, about 50 percent of those who tried the Feingold diet in these studies displayed a decrease in symptoms of hyperactivity (Conners, 1976).

While the U.S. studies have been largely negative, the reports from Australia and Canada have been more supportive of the Feingold hypothesis. Feingold has contended that there is a conflict of interest on the part of the USA Nutrition Foundation, an organization supported by the major food manufacturers (Coca-Cola, Nabisco, General Foods, etc.). It appears that the Nutrition Foundation has financed most of these negative studies (Matters, 1983), and if food additives were found to be harmful, these companies would suffer economically. Other countries have significantly restricted the use of artificial food additives because of the possible harmful effects. More studies in Australia have shown that food additives and food allergens are common causes of ADHD. In one study, 19 out of 26 children with hyperactivity responded favorably to an elimination diet (Rowe, 1994). In another study, 59 out of 78 children responded to an elimination diet (Boris and Mandel, 1994). In both studies, double-blind, placebo-controlled food challenges confirmed the negative effects of food additives and food allergies on behavior and mental performance.

Fitzsimon and Holborow (1978) studied twelve children, aged 6 to 13 years, whose parents reported an improvement in behavioral problems with use of the Feingold diet for an average period of 12 months, were then challenge-tested with 40 mg of acetylsalicylic acid in a double-blind, cross-over trial with ascorbic acid as a placebo. Significance was reached in tests of general cognitive capacity, line walking and the "finger-to-nose" tests, as well as increased disturbance in sleep patterns in the children who were treated with salicylates.

In a study by Baterman, et al. (2004) to determine whether artificial food colorings and a preservative in the diet of 3 year old children in the general population influence hyperactive behavior, 1873 children were tested. The results indicated that there were significant reductions in hyperactive behavior during the withdrawal phase. Furthermore, there were significantly greater increases in hyperactive behavior during the “active period” than the “placebo period” based on parental reports. The conclusions were**: There is a general adverse effect of artificial food coloring and benzoate preservatives on the behavior of 3 year old children** which is detectable by parents but not by a simple clinic assessment. [2]

[2] 20 mg per day of coloring was used as the "challenge." Imagine the results had they used the 150 mg of coloring present in one (1) Tbs of green ketchup.

Since the standard techniques in the management of hyperkinetic children are not uniformly successful, there has been considerable interest in dietary therapy. The diet, low in artificial colors, flavors and in naturally occurring salicylates has been adapted for use in New Zealand. Ten hyperkinetic children have been treated with the diet, five of whom improved dramatically and are now off all other therapy. Their response to accidental and deliberate challenge supports the hypothesis that the dietary regime described has been responsible for their improvement (Hindler and Preist, 1978). In a study by Carter, et al. (1993) - 59 of 78 children (75.6%) referred for "hyperactive behavior" improved on an open trial of an elimination diet. Only 19 of them were studied in a placebo-controlled double-blind challenge protocol**.** As Carter, et al. (1993) have shown, controlled food challenge usually validates parental suspicions of food-induction of behavioral symptoms. It is possible that selection bias factitiously elevates the percentage of diet responders in some or all of these reports, since parents who consent to participation in diet studies may include a disproportionate number who believe they have observed food-induced problems in their children. On the other hand, lower percentages of subjects with food sensitivities confirmed on double-blind food challenges, compared to percentages responding in open diet trials, are due in part to the failure of some subjects who complete the preliminary open phase of the study to participate in the final double-blind phase; food sensitivities of those subjects who complete the open trial but do not participate in double-blind food challenge are counted (with non-responders) as non-confirmed by double-blind challenge. Children who are sensitive to dyes and food chemicals (especially salicylates) **do** respond to the Feingold Diet. “Junk food” has too many reasons to avoid it.

Parents are advised to feed the child as if he was diabetic, use only wholesome balanced foods, avoid fast foods, look for allergies and be sensitive to chemical additives (Carter, et al. 1993).

There are more than 40,000 chemicals added to foods in the US. In Europe – you will only be exposed to 20 (Anthony, 1997). Food dyes and chemicals will cause ADHD in susceptible children. If the child is sensitive to sulfa drugs or Aspirin, all dyes should be avoided. Dengate and Ruben (2002) studied twenty-seven children, whose behavior improved significantly on the “Royal Prince Alfred Hospital diet”, which excludes food additives, natural salicylates, amines and glutamates, and who were challenged with calcium propionate (preservative code 282) or placebo through daily

bread in a double-blind placebo-controlled crossover trial. Their conclusions were that irritability, restlessness, inattention and sleep disturbance in some children may be caused by a preservative in foods consumed daily. Minimizing the concentrations added to processed foods would reduce adverse reactions.

These reports demonstrate that there is no single dietary regimen that is best for all children with hyperactivity and/or ADD. Each subject underwent a period of dietary elimination followed by oral challenges with specific foods, to determine his or her "ideal" diet. Many children in these studies reacted not only to one food, but to several, which makes it difficult for the researchers to isolate.

b. Sucrose

It has been demonstrated that destructive-aggressive and restless behavior significantly correlates with the amount of sucrose consumed. Hypoglycemia promotes hyperactivity through increased adrenalin secretion. Refined carbohydrate consumption appears to be the major factor in promoting reactive hypoglycemia (that is the result of a quick elevation in blood sugar for 1-2 hours followed by a severe drop in blood sugar levels) (Sanders, et al. 1982).

Positron-Emission-Tomography (PET) studies have revealed that individuals with ADD/ADHD have difficulty with glucose metabolism and have blood sugar problems. Children are affected most by blood sugar problems due to the fact that half of their daily caloric intake is used to fuel brain activity. ADHD children release only about half the amount of catecholamines as normal children. Using PET scans, researchers found an uncontrolled drop in blood sugar, which significantly decreased brain activity in ADHD children. They become physically hyperactive in an unconscious effort to force their adrenal glands to release more catecholamines (these are the hormones commonly referred to as "adrenaline" that can result in extraordinary acts of strength during time of stress). These children apparently are placing their body under stress in attempt to "squeeze" more hormones from their already weakened adrenal glands. The conclusion is to eliminate refined sugars as much as possible (Wolraich, et al., 1995). Too much sugar intake also facilitates the growth of Candida Albicans and other kinds of yeast and fungus in the gastrointestinal tract, which thrive on sugars and produce toxins that affect the nervous system and the brain (Shaw, 1998).

c. Food Allergies (sensitivities)

Double-blind studies have provided scientific evidence for the relationship between food allergies, food additives, and behavior (Egger, et al. 1985, Egger, et al. 1992, Boris and Mandel, 1994). Elimination of food additives from the diet is not enough. The diet must be also free of any food allergens, such as **milk or wheat**. In a large controlled study, 76 severely hyperactive children were treated with low allergen diet, and after 4 weeks, 62 children improved (82 percent). A normal range of behavior was achieved in 21 of these children. Other symptoms, such as headaches, abdominal

pain, and fits, were also relieved (Egger, et al. 1985). Reintroduction of the foods to which the child was sensitive led to reappearance of symptoms and hyperactive behavior. These results were reproduced in larger studies (Rapp, 1991). 185 children with established hyperkinetic syndrome were put on a low allergen diet for 4 weeks. The diet consisted of 2 meats (lamb and chicken), 2 carbohydrates (potatoes and rice), 2 fruits (bananas and pears), vegetables (cabbage, sprouts, cauliflower, broccoli, cucumber, celery and carrots), and water. They were supplemented with calcium, magnesium, zinc, and some basic vitamins. Behavior of 116 of these children improved (62%), and foods that provoked hyperactivity were identified by sequential reintroduction (Egger, 1992).

In order to determine whether food-induced hyperactivity would respond to allergy desensitization treatment, Egger, Stolla, and McEwen (1992) carried out a double-blind trial of enzyme potentiated desensitization (EPD) treatment in a group of children diagnosed with this condition. Open food challenges were conducted before and after a series of EPD injections. All 16 children who completed three active EPD injections at intervals of 2 months became tolerant of provoking foods, compared with only 4 of the 20 children who completed the same number of placebo injections ($p<0.001$). Adverse effects of EPD injections were limited to transient local discomfort at injection sites. In those actively treated subjects whose food sensitivity returned after completion of the trial, desensitization was restored by additional EPD injections. They concluded that hyperactive behavior is related to allergic response.

Doris Rapp, MD (1991) is one of the pioneers of work in food allergy. Speaking out of her 40 years experience, she states that 66% of ADHD children are allergic to foods. She invites us not to forget pollen, mold and chemicals, but cow's milk, wheat and corn are the most common triggers for ADHD. Dr. Rapp says that symptoms can be controlled in 3 days.

2. Attention Deficit Disorder without Hyperactivity- ADD/learning disability

Three factors appear to be particularly relevant to ADD/learning disabilities:

a. Otitis media.
b. Nutrient deficiencies.

c. Heavy metals.

a. Otitis Media

Children with moderate or severe hearing loss tend to have impaired speech and language development, lowered general intelligence scores, and learning difficulties (Silva, et al. 1982). Current and frequent ear infections have been reported to be twice as common in learning-disabled children as non-learning-disabled children. This reconfirms the necessity of dealing with otitis media from a preventive standpoint, since many of the factors associated with ADD are also associated with otitis media (Reichman and Healy, 1983).

A positive correlation between recurrent middle ear infections (otitis media) in infancy and the later diagnosis of ADD has been demonstrated by Hagerman and Falkenstein (1987) who postulate that effective strategies to reduce the incidence of otitis media might actually serve to prevent cases of ADD. The authors' suggestion that, in order to reduce the prevalence of ADD, antibiotics should be given vigorously to prevent otitis media (page 256) assumes not only that otitis media is a cause of hyperactivity and not merely an associated condition, but also that aggressive antibiotic treatment can reduce the incidence of otitis media. The former assumption is untested; the latter is almost certainly incorrect.

A number of workers, failing to find any statistically verifiable advantage of antibiotics for otitis media, have recommended their use only after 3 to 4 days of observation with analgesics and nose drops alone, and only in those cases in which there is convincing evidence of focal bacterial infection, the course of otitis is irregular, or there are complications such as mastoiditis or ear discharge persisting beyond 14 days (Van Buchem, 1985).

Cantekin (1991) used a double-blind, placebo-controlled randomized trial specifically to assess the efficacy of amoxicillin for otitis media with effusion (OME). No benefit was found, and unexpectedly, amoxicillin significantly increased the recurrence rate of OME. Theoretical discussions of possible mechanisms by which antibiotics might increase the incidence of otitis media have focused on their tendency to cause microbes which do not normally colonize the bowel to replace normal antibiotic-sensitive intestinal flora. This might allow absorption of toxic microbial products and/ or alter host immunity. As an example, broad spectrum antibiotics, by destroying

normal bacteria, allow intestinal proliferation of Candida albicans, a fungus known to induce measurable changes in immune function (Domer and Garner, 1989).

The Developmental Delay Registry, a network of parents of children suffering from a wide spectrum of developmental disorders encompassing hyperactivity and ADD, has reported a survey directly correlating these disorders with antibiotic use. The average number of courses of antibiotic was 12.84 among 449 children diagnosed with developmental delays, compared with 9.71 for 247 normally developing controls. Increased antibiotic use may simply reflect the higher incidence of infections in children with hyperactivity, as reported by Hagerman and Falkenstein (1987). On the other hand, a role for antibiotics in causing hyperactivity would be expected if Cantekin's observation (1991) that antibiotics increase recurrence of otitis media, and the assumption that recurrent otitis media causes hyperactivity, are both correct.

While antibiotics may have distanced us from the goal of preventing middle ear infections, yet another clinical strategy is likely to bring us closer; a recent report by Nsouli (1994) confirms that **elimination diets for food allergy can effectively treat and prevent recurrent otitis media**. Elimination diets significantly ameliorated OME in 81 of 104 children (86%) entered in this study. Re-challenging with suspected offending foods provoked a recurrence of OME in 66 out of 70 (94%). As with hyperactivity, the demonstrated benefits of elimination diets for OME are contingent on positive diagnostic of oral food challenges, after a successful exclusion diet. In otitis media, cow's milk, wheat, soy, egg white, peanut, and corn are the most frequent provoking foods (Nsouli et al, 1994).

Given the state of this research, further scientific investigation is warranted to determine whether better diagnosis and treatment of food allergies and restraint in the use of antibiotics will reduce the incidence of otitis media and the prevalence of ADD.

b. Heavy metals

Numerous studies have demonstrated a strong relationship between childhood learning disabilities (and other disorders, including criminal behavior) and body stores of heavy metals, particularly lead (David, et al. 1972; David, et al. 1976; Rimland and Larson, 1983).

Learning disabilities seem to be characterized by a general pattern of high level of mercury, cadmium, lead, copper, and manganese, as determined by hair analysis (Rimland and Larson, 1983). Poor nutrition and elevation of heavy metals go hand in hand, due to decreased consumption of food factors known to chelate these heavy metals or decrease their absorption. Screening for lead toxicity is an essential process when evaluating a child with symptoms of ADD or developmental delay (Krohn and Taylor, 2000).

c. Nutrient Deficiency

Any nutrient deficiency can result in impaired brain function. Iron deficiency is the most common nutrient deficiency in American children. Iron deficiency is associated with markedly decreased attentiveness, less complex or purposeful, narrower attention span decreased persistence and decreased voluntary activity, which is usually responsive to supplementation (Werbach, 1991; Stordy and Nicholl, 2000).

It has been reported that children with malnutrition (fed mainly on "junk" foods – pizza, coca-cola, hamburgers, sweets and refined sugars and refined carbohydrates, etc.) have more problems with concentration, memory and learning than children who eat more balanced, natural diet, rich with fruits and vegetables, whole grains and legumes (Krause and Mahan, 1987; Robbins, 2000). Also, supplementation with vitamins and essential fatty acids has shown an improvement in the cognitive functions of these children (Rapp, 1991; Stordy, 2000). Several investigations have demonstrated that corrections of even subtle nutritional deficiencies exert a substantial influence on learning and behavior (Perkins, 1977, Colgan and Colgan, 1984).

A few studies have compared stimulants-treatment for ADD with nutritional-supplemental-treatment. Coleman, et al. (1979) published a report comparing methylphenidate (Ritalin) with pyridoxine (vitamin B6), for the treatment of hyperactivity. Only 6 subjects participated, and these children were selected on the basis of their low blood serotonin levels and their previous positive responses to methylphenidate. All subjects received a 3-week trial each of

placebo, low dose pyridoxine, high dose pyridoxine, low dose methylphenidate, and high dose methylphenidate. In this group, behavioral improvement on pyridoxine exceeded that of methylphenidate, both in magnitude and in persistence of improvement after cessation of treatment; both active treatments were superior to placebo. Blood serotonin, while not consistently affected by methylphenidate or placebo, rose with pyridoxine treatment, and remained increased during the post-pyridoxine persistence of behavioral improvement. The intriguing results of this study, which has yet to be repeated with a larger sample, have remained unchallenged since publication in 1979 (Anthony, 1999).

Harding, et al. (2003) studied twenty children with ADHD. They treated them with either Ritalin (10 children) or dietary supplements (10 children). Subjects in both groups showed significant gains.

Numerous studies suggest that biochemical heterogeneous etiologies for ADHD cluster around at least eight risk factors: food and additive allergies, heavy metal toxicity and other environmental toxins, low-protein/high-carbohydrate diets, mineral imbalances, essential fatty acid and phospholipid deficiencies, amino acid deficiencies, thyroid disorders, and B-vitamin deficiencies. These findings support the effectiveness of food supplement treatment in improving attention and self-control in children with ADHD and suggest that food supplement treatment of ADHD may be of equal efficacy to Ritalin treatment (Stordy and Nicholl, 2000; Zimmerman, 1999; Schmidt, 1997; Hill and Wyman, 1997).

Given the many potential causes of ADHD, specifically addressing the relevant probable factors can be critical to establishing an appropriate treatment regimen for an individual child (Anthony, 1999).

Approaches that lie outside of the orthodox medical protocol include aromatherapy, biofeedback, chiropractic, Chinese medicine, cranial-sacral therapy, flower remedies, homeopathy, hypnotherapy, massage therapy, and sound and vision therapy. However, **nutritional and supplementation solutions for ADHD** will be the two modalities explored here.

3. Diet and ADD/ADHD

How important is the diet of an ADHD child?

Very important, according to a 1997 study published in the Journal of Pediatric Child Health. Author Jean Breakey (1997) reviewed the most important research from 1985 to 1995 on the relationship between diet and behavior. She concluded that diet definitely affects some children and that symptoms relating to ADHD, such as sleep problems, physical symptoms and mood changes, can change with diet.

A 1998 review conducted at the National Defense Medical College in Japan and published in the Journal of Gastroenterology Hepatology discussed dietary fat intake and its modulating effects on the intestinal immune system as it applies to Crohn's disease (Miura 1998). The researchers found that unsaturated fatty acids, particularly at higher concentrations, suppressed cell-mediated immunity within the gut-associated lymphoid tissue. This in turn induced relapse of Crohn's disease. Although this study focused on the effect on Crohn's disease, the study's findings may be extrapolated to ADHD and other disorders in which the gut immune system reacts with food components, food-based allergens and nutrient depletions. While clinical investigations continue, the application of these issues should be part of an integrated treatment regimen to ameliorate ADHD (Stordy and Nicholl, 2000).

The Washington, D.C., based Center for Science in the Public Interest (CSPI) cited 17 controlled studies in a 1999 report that found that diet adversely affects some children's behavior, sometimes dramatically. Most of the studies focused on artificial colors, while some also examined the effects of milk, corn and other common foods. The percentage of children who were affected by diet and the magnitude of the effect varied widely among the studies. Six other studies did not detect any behavioral effect of diet (Stordy and Nicholl, 2000).

In 1997, researchers at Germany's Central Institute of Mental Health evaluated 49 children with hyperactive/disruptive behavior disorder. This placebo-controlled,

double-blind, crossover study comparing drugs to diet alone found "significant behavioral improvement" in 24 percent of the children who underwent dietary treatment. Although stimulant medications improved 44 percent, researchers concluded that diet "cannot be neglected" in ADHD treatment (Stordy and Nicholl, 2000).

There are three trials (Egger 1985, Carter 1993, Borris 1994), which report substantial improvement and significant reduction of Conners' scores in hyperactive children on a hypoallergenic diet; over 70% of children responded in each study. The results were confirmed with double blind placebo controlled challenges; significantly higher scores were recorded during periods on challenge food rather than on placebo. These trials used a stringent few-food hypoallergenic diet during the investigative phase, with very slow challenges.

In a study by Boris and Mandel (1994) 73% of the children responded favorably to elimination diet ($P < .001$). This study demonstrated a beneficial effect of eliminating reactive foods and artificial colors in children with ADHD. Dietary factors may play a significant role in the etiology of the majority of children with ADHD. The research has shown that diet definitely affects some children and some non-food items are relevant. Symptoms that may change include those seen in attention deficit disorder (ADD) and attention deficit hyperactivity disorder (ADHD), sleep problems and physical symptoms, with later research emphasizing particularly changes in mood.

It was found that during consumption of provoking foods there was a significant increase in betal activity in the fronto-temporal areas of the brain (Uhlig, 1997). This investigation is the first one to show an association between brain electrical activity and intake of provoking foods in children with food-induced ADHD. Standard diets are **not** helpful in the management of this disorder because the foods that provoke hyperactive behavior are different for each child. Few parents succeed in identifying the foods that affect their child without help, but an elimination diet is effective in most cases. Deficiencies of essential fatty acids are common in these children (Stevens, 1995, Stordy and Nicholl, 2000). If they have had help with finding alternative foods, most parents find it surprisingly easy to keep the child to the diet most of the time after the first few weeks because the child usually prefers to feel well (Rapp, 1997).

Elimination Diet

Dealing with the diet of an ADHD child can be difficult. Furthermore, corrective nutritional changes made at home can be usurped if a child eats the wrong foods at school. Regardless of the pitfalls, however, the benefits of proper nutrition are critical to modulating ADHD behavior. The needed changes in diet can be addressed in a variety of ways. One way to begin nutritional changes is to institute an elimination or food-reduction diet. This type of diet is used to reduce the number and types of food sources and can target artificial food colors and preservatives, limit foods that may be causing sensitivities and/or allergies, and decrease the amount of sugar eaten.

The principles of elimination dieting are set out in a text (Anthony, 1997). Provoking foods or food additives are usually those eaten frequently; it is rare for a single item to be responsible for ADHD. Most of the probable provoking substances must be avoided completely and simultaneously to get good results. It may be sufficient to avoid additives (especially colors and preservatives in food, drink, medicine, and toothpaste), chocolate, milk, and orange, to which most hyperactive children react (Carter, 1993). However, reactions to cheese, wheat, and other fruit are also common and any food may provoke hyperactivity, especially if eaten frequently. An improvement is often seen in children within 3-7 days, and single open oral challenges are usually sufficient if given within three weeks. Foods that cause a distinct deterioration in behavior should be avoided for several months, by which time they can often be tolerated if not eaten too frequently. The diet may relieve other conditions—for example, glue ear or abdominal pain, which are also present in many of these children (Carter, 1993, Anthony, 1997). Finally, the nutritional quality of longer-term diets should be checked by a dietician. If the diet is effective, behavior often reverts to normal, to the great relief of all concerned. In view of the potential toxicity of medication in children and its limited effectiveness, all families with hyperactive children should be offered help in detecting offending foods. It is more appropriate to reserve medication for those who fail (Anthony, 1997).

The first stage of a food elimination program is implemented by removing many foods from the diet such as junk foods; sugars; dairy products; whole grains such as

corn, barley and wheat; chocolate and other candy; citrus fruits; and food colorings and additives. After elimination, unprocessed foods are reduced to basic items, such as specific fruits and vegetables only. The restricted, whole-food diet is kept in place a minimum of eight to 12 weeks and the child's behavioral responses are observed (Rapp, 1991; Anthony, 1997).

The second stage reintroduces a particular whole food, such as whole grains, citrus fruits, poultry or fish. These whole foods are introduced individually and only one at a time. This "food loading" method allows observation of behavioral and personality changes in the child that can be associated with the inclusion of a specific food.

The final stage of the elimination diet establishes a long-term, whole food diet that is varied and tolerated by the child without causing negative physical and behavioral reactions.

Complementary medicine principles offer several aids in changing dietary patterns and supplementing with vitamins or minerals. Chocolate, sugar, sweeteners, additives, preservatives, dyes, can enhance the incidence of this syndrome and should be avoided**;** the supplementation with lipids rich in PUFA's can prevent it**.** B complex vitamins, magnesium, zinc, copper, manganese or calcium, and sedative plants like passion flower, valerian, thyme, chamomile or lemon balm, as well as evening primrose oil or borage oil are useful aids. Also licorice, fennel and berries can be used for different physiological actions (Berdonces, 2001). Supplemental Help for ADHD will be discussed further in more detail

The **Feingold** (1975, 1982) hypothesis associating hyperkinetic syndrome with ingestion of common food additives, artificial colors and flavors, and salicylates-containing foods has evoked considerable controversy. Since many children ingest these ubiquitous additives, and no differences in dietary habits have been noted between hyperkinetic and non-hyperkinetic children, it is possible that a biochemical difference may be present in children who appear to be affected by the additives.

Dr. Ben Feingold wrote in 1982 that “the behavioral disorders, frequently labeled hyperkinesis, hyperkinetic impulse disorder, hyperactivity, Minimal Brain Dysfunction (MBD) and Attentional Deficit Disorder (ADD), are among the most critical problems of our contemporary culture… Truancy, vandalism, violence and

assault among schoolchildren coupled with a persistent drop in scholastic achievement is a universal problem affecting the school population of every so-called developed country. Every procedure for the control of behavioral disorders has not been successful; every technique for the improvement of learning has not been productive, while every modality for the rehabilitation of delinquents has failed us. Since all these procedures have been structured upon psychosocial concepts, it becomes necessary to look elsewhere for the answers, which is to the biosciences, including genetics, molecular genetics, pharmacogenetics, behavioral toxicology, behavioral teratology, immunochemistry, immunology, allergy and endocrinology, with a focus upon nutrition, which encompasses all these disciplines" (Feingold,1982, p.153).

4. Supplemental Help for ADHD

Beyond the whole-food diet, a simple way of getting critical nutrients into an ADHD child is with supplements. The issues surrounding needed nutrient levels and supplementation in ADHD continue to be controversial, but research is increasing. The topic of nutritional supplementation was addressed by Leo Galland, M.D. at a 1999 conference on ADHD in Arlington, Va. Galland presented information on the types of nutritional supplements that have been used in treating children with ADHD as reported in published studies. Some of the supplements Galland discussed include certain B vitamins (B1, B2, B5, B6, B12), essential fatty acids, magnesium, zinc, iron, manganese, potassium, amino acids, dimethyl-aminoethanol (DMAE), phosphatidylserine (PS), and oligosaccharides (Stordy and Nicholl, 2000).

Much of the nutrient research conducted over the years has centered on the various supplements discussed by Galland (In Stordy and Nicholl, 2000). Mineral and essential fatty acid research has been explicitly focused on ADHD, proven to be beneficial for treating ADHD patients.

Essential fatty acids and their effects on ADHD behavior have been the subject of much research during the last ten years. A 1995 study by researchers in the department of foods and nutrition at Purdue University in West Lafayette, Ind. evaluated essential fatty acid metabolism in 96 boys, 53 with ADHD and 43 controls. The study found the 53 ADHD subjects had significantly lower concentrations of omega-3 and omega-6 fatty acids in their blood plasma (Stevens, et al. 1995). A follow-up study by this same group of researchers further documented plasma deficiencies of the essential fatty acid docosahexaenoic acid (DHA) in ADHD children (Stevens, et al. 1999).

Dr. Stordy, in her book about Long Chain Polyunsaturated fatty acid supplementation (2000), shows how it dramatically improves the lives of ADHD and learning disabled children and adults. Flaxseed oil, salmon oil, borage oil, and evening primrose oil are examples of this beneficial supplementation of omega-3 and omega-6 fatty acids.

Vitamin B complex is needed for correct brain function and digestion (especially vitamin B5 and B6). B5 and B6 also enhance adrenal gland function. High dose of

vitamin B6 was compared with Ritalin or a placebo, as mentioned above, and the B6 was found to be just as effective as Ritalin (Coleman, 1979). B6 is cheaper and less harmful than Ritalin, but Ritalin is much more profitable, so there are no more studies about that. The recommended dosage is about 8 mg of B6 per pound of body weight per day (Shaw, 1998). Vitamin B6 is found in oranges, leafy and dark green vegetables, whole grains, peas, legumes, eggs and brewer's yeast. It is known that all vitamin B complex vitamins must be taken simultaneously or in a certain ratio to one another (Gerber, 1992).

Zinc levels also strongly correlate with ADHD. Psychiatry department researchers at Technical University in Turkey compared 48 ADHD children to 45 non-ADHD children. While free fatty acid levels in blood serum were nearly four times lower in ADHD children, mean serum zinc levels in ADHD patients were also less than half the levels of the controls (Stordy and Nicholl, 2000). A deficiency in this essential mineral has been shown to affect children's behavior and learning. Rich sources of zinc include whole grains, eggs, nuts and seeds (Sears and Thompson, 1998).

Magnesium and ADHD is another area of increasing interest. Researchers at the Department of Family Medicine in Szczecin, Poland, studied 116 ADHD children ages 9 to 12 for blood serum levels of magnesium. Remarkably, magnesium deficiency was found in 95 percent of those examined (Kozielec 1997). 50 children were given 6 mg of magnesium per pound of body weight for 6 months. A comparison group of 25 served as controls and were not supplemented. Those children who had the supplement showed an increase in magnesium in their body and decrease in hyperactivity. Magnesium is very important for muscle and nerve membrane function and energy metabolism. It is also closely involved in calcium and phosphate metabolism. Deficient individuals suffer from muscular weakness and neuromuscular dysfunction. The heart beats more rapidly and severe deficiency leads to coma and death. Foods rich in magnesium include nuts, grains, peas, and green leafy vegetables. Calcium and magnesium at bedtime have a calming effect (Murray and Pizzorno, 1998).

Iron helps regulate the activity of dopamine, a neurotransmitter implicated in some forms of psychosis. Israeli researchers at Tel- Aviv University evaluated 14 ADHD

boys between the ages of 7 and 11 for the effect of short-term iron administration on behavior. Each boy received 5mg/kg body weight of iron daily for 30 days. Both parents and teachers assessed their behavior. In the end, the parents thought the children improved; their ratings dropped from 17.6 to 12.7. However, there was no change in the teachers' scores (Sever, et al. 1997). Insufficient iron in a child's diet can contribute to ADHD symptoms, such as inattention, aggression, and irritability. When children who are iron deficient are given iron supplements, they learn and behave better (Sears and Thompson, 1998). The behavioral effects of low blood-iron levels can occur before the problem is detected by a hemoglobin test or diagnosed with anemia. Foods that interfere with iron absorption, such as coffee, tea, colas and chocolate (all contain caffeine) as well as milk should be avoided. Iron containing foods are soybeans, barley, lentils, beets and raisins. Eating or drinking foods high in vitamin C (such as orange juice) with meals enhances iron absorption from foods (Sears and Thompson, 1998, Armstrong, 1997).

Serotonin levels may also affect ADHD patients. Serotonin is one of the neurotransmitters in the brain. It is the chemical that causes us to feel sleepy after a big meal (especially a meal that has a lot of refined carbohydrates in it). However, during the day it can also result in our feeling restless, irritable, or inattentive. Sudden surges of serotonin can also throw off levels of other transmitters such as dopamine and norepinephrine. Proteins, however, increase the level of amino-acids, and these block many of the effects of serotonin (suggesting that excess protein may contribute to ADHD) (Armstrong, 1997). Researchers at Ness Ziona Mental Health Center in Israel found blood levels of serotonin tended to be lower in children with more severe markers of hyperactivity, impulsiveness, aggressiveness and lack of concentration. Supplementation with 5-hydroxytryptophan (5-HTP), a serotonin precursor, may consequently help those with more severe ADHD symptoms (Anthony, 1999).

In conclusion, ADHD is a difficult disorder for all concerned - the child, family, parents, and teachers. Current treatment focuses on standard medication as its primary model. But there are other, perhaps better, ways to deal with ADHD. The key is in the foods we allow our children to eat and critical supplements that need to be utilized. Nutritional therapy and a variety of other holistic-care approaches can be the key

to taming ADHD.

B. What is Autism?

Autism is a developmental disorder, which is characterized by lack of communication, lack of speech, severe social disability and isolation from the surrounding, and repetitive behaviors (Kaplan, et al, 1999). Once rare, Autism has reached epidemic proportions in the United States. The increase cannot be attributed to changes in diagnostic criteria, which have actually become more restrictive. Already a heavy burden on educational facilities, the increasing number of patients afflicted with this serious disability will have an enormous effect on the economy as the affected children reach adulthood. Studies of all possible causes of the epidemic are urgently needed. To date, studies of a potential relationship to childhood vaccines have been limited and flawed (Shaw, 1998).

a. Historical Background

The important historical observation about Autism is that it was unknown in ancient cultures, or even in medieval times, and that it was first documented about 60 years ago. Leo Kanner, while at Johns Hopkins, Baltimore, was first to describe Autism in 1943 (Kanner, 1943). His article described 11 children who had an apparently rare syndrome of extreme Autistic aloneness. Because these children's symptoms started early, Kanner's Syndrome was also known as Infantile Autism (Kanner, 1943). In 1944, Hans Asperger from Vienna also described a group of children with similar symptoms who were highly recognizable (Asperger, 1944). In the same year, Bruno Bettelheim theorized that children developed Autism because their "refrigerator mothers" raised them in a non-stimulating environment, with resulting damage to their social, language and general development. Bettelheim's credentials were questionable, and his theory has been discredited (Tiano, 1997).

Bernard Rimland, Ph.D., founder of the Autism Society of America and founding president of the Autism Research Institute (ARI), has thoroughly analyzed the ARI database of more than 30,000 entries and reported two clear trends:

First, the incidence of Autism has increased explosively in recent years. Second, a distinct shift in the time of onset of Autistic symptoms has become evident (Rimland, 1999, 2003). Late onset Autism (starting in the second year) was almost unheard of in the 1950s, 60s, and 70s; Today such cases outnumber early onset cases five to one. Parents in increasing numbers are reporting similar stories (Shaw, 1998): A child,

most often a boy, who is developmentally, socially, and verbally on par for his age, suddenly stops acquiring new words and skills in the second year of life, and then regresses, losing speech, cognitive abilities, and social dexterity. Children in this group are said to have Regressive Autism. Further, overwhelmed parents may drift apart, and siblings' stress may be manifested as behavior problems. Suggesting that a sudden and exponential increase in Autistic disorders is not real, and results only from better diagnosis, amounts to denial. Similarly, though some affected children have Fragile-X Syndrome or a family history of Autism, it does not seem reasonable to insist that the present Autism outbreak is solely caused by hereditary factors. Genetic disorders have never presented as epidemics, and investing the scant available resources solely in genetic research diverts them from the scientific exploration of more plausible environmental etiological factors (Shaw, 1998; Rimland, 1999, 2003).
In the last 12 years, the number of children with Autism between 6 and 21 years of age attending school in the U.S. rose at a much faster rate than the number of children with disabilities in general (Rimland, 2003). Figure 2.1 shows the increase in Autism and all disabilities in U.S. schools from 1991-92 to 2001-02:

	1991-1992	2001-2002	% Increase
Autism	5,315	97,847	1,700
All Disabilities	4,499,924	5,853,830	30

Figure 2.1: The increase in Autism and All Disabilities in U.S. Schools 1991-92 to 2001-02 Source:U.S. Department of Education Annual Reports to Congress (IDEA)

Research has shown that in the last decade the number of Autistic children has grown 10 times more. 10 years ago the number was 1 to 10,000 children and today – it is 1 to 250 children (Yazbak, 2003) and 1 to 150 more recently. The Autism explosion since 1994 is best documented in California, where the Department of Developmental Services (DDS) regularly reports all new cases of the disorder introduced in the system. There were 633 cases of DSM IV Autism in 1994. Within 5 years (1999), the number of new cases had risen to 1,944 or 6 new cases a day, 7 days a week. There were 2,725 confirmed new cases of Autism added to the system in 2001 and 3,577 more in 2002 or ten children a day. That one-year increase of 31 percent was the highest in the 33-year history of the department. Children with Autism under age 3

and those with PDD-NOS and Asperger's Syndrome were not included (Yazbak, 2003).

Figures 2.2 and 2.3 show the Autism epidemic in years 1992-2003 compared to increase in all disabilities (ages 6-22) (both graphs were taken from www.fightingautism.org, 2005).

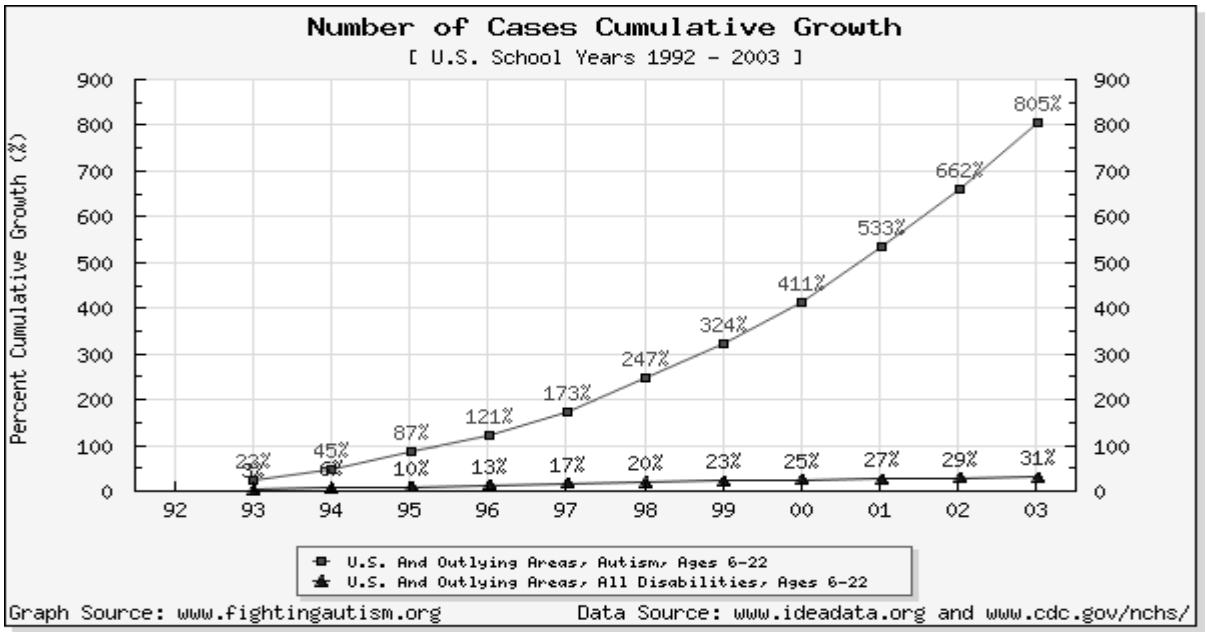

Figure 2.2: Increase in number of cases of Autism years 1992-2003

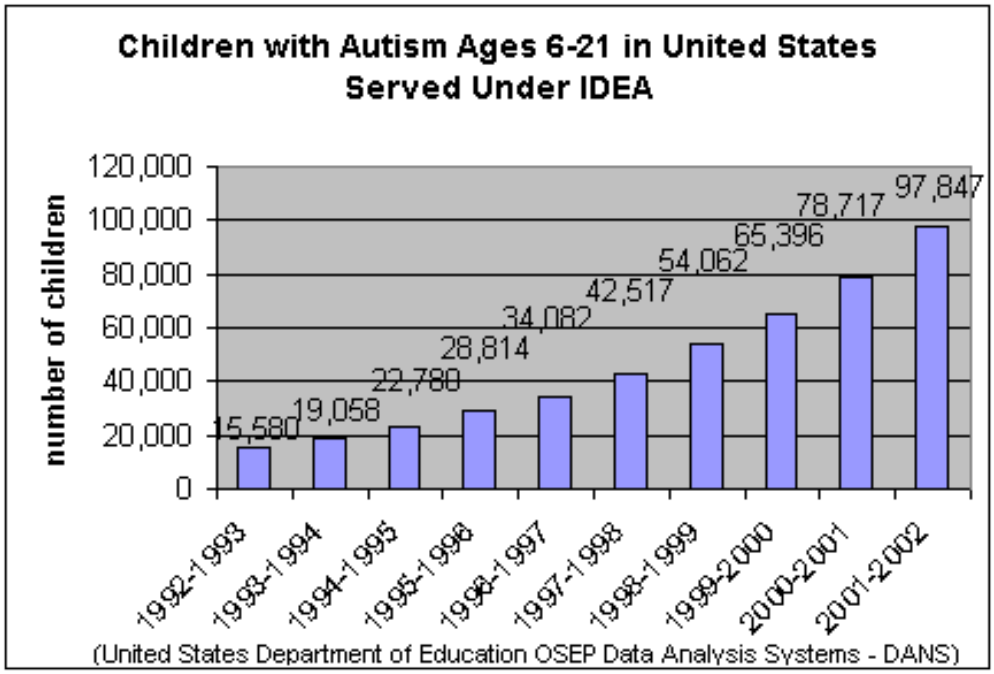

Figure 2.3: Increase in Autism years 1992-2002

One in 500 children suffered from Autism in Israel during the time reference reported in 2005, in the ratio of 4 boys to 1 girl. 2000 Autistic children live now in Israel, and every year 240 more children are diagnosed. Usually, the child is diagnosed before age 3 (The Israeli Autism Institute, 2005).

b. Diagnosing Autism

Autism is a condition that stands on the edge of the spectrum of PDD (pervasive developmental disorder). There are many different stages or levels of PDD and Autism, but the common elements are in the 3 areas of social interaction, verbal and non-verbal communication, and limited interest and activity. Autistic children display other characteristics such as repetitive behaviors, objection to changes in their close environment or in their regular routine, and disorders in the sensory systems, which cause extreme reactions to stimulations such as touch, light or sound (Tiano, 1997).

Autistic children vary in their intelligence and in their behavior. The spectrum is quite wide, and each child is unique in the level of disturbance. 70-80% of Autistic children are mentally retarded; the rest have normal intelligence (Tiano, 1997).

There is a genetic component for Autism. There is a 50% chance that a second Autistic child will be born to a family that already has one, (Tiano, 1997).

The rise in number of children with Autistic disorder could be attributed not only to a rise in diagnostic capability and public awareness of the problem, but also to a reaction to the MMR vaccinations, and/or to nutritional factors (such as a reaction to gluten and casein), that will be discussed in greater detail (Shaw, 1998, 2003).

Diagnosing Autism is very confusing because there are no physiological indicators as there are for diabetes or cancer. Doctors may not always find the genetic markers they search for with other disorders, because Autism has many possible causes. It is only diagnosed when the child exhibits certain overt behavioral and psychological symptoms (Tiano, 1997). Other symptoms are immunological, dermatological, digestive, sensory, neurological, respiratory, cognitive, psychological, and developmental. If the symptoms are mild, a child may be diagnosed with Attention Deficit Disorder (with or without Hyperactivity). Moderate symptoms might result in a diagnosis of Asperger's Syndrome. If severe, the diagnosis would be PDD or

Autism (as seen on the neuro-behavioral spectrum) (California Dept. of Developmental Services, 2003).

In 1956, Kanner and Eisenberg proposed that just essential features were required to make a diagnosis of Autism: Profound lack of affective contact and repetitive, ritualistic, elaborate behavior (Kanner, 1956). In 1978, Rutter proposed that a definition of Autism in children required these criteria: (1) Impaired social development out of keeping with the child's intellectual level; (2) impaired language development out of keeping with the child's intellectual level; (3) stereotyped play patterns, abnormal preoccupations, and resistance to change; and (4) onset before the age of 30 months (Rutter, 1978).

In 1980, DSM III (Third Edition), was introduced, and its classification of infantile Autism required the following criteria: (1) Lack of responsiveness to others; (2) language absence or abnormalities; (3) resistance to change or attachment to objects; (4) absence of schizophrenic features; and (5) onset before 30 months (DSM III, 1980).

In 1987, the diagnostic criteria for Autism were revised (DSM *Diagnostic and Statistical Manual of Mental Disorders* III-R), and a definition of pervasive developmental disorders was introduced. Other countries had their own sets of criteria (DSM III-R, 1987).

Since 1994, the required criteria for Autistic Disorder 299.00 have been those established in the DSM IV, shown here. Similarly, detailed and strict criteria were outlined for Asperger's Syndrome (AS) and Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS) 299.80 (DSM IV, 1994).

Diagnostic and Statistical Manual of *Mental Disorders* DSM-IV Criteria for Diagnosis of Autism 299.00

(I) A total of six or more items from (A), (B), and (C), with at least two from (A), and one each from (B) and (C):

(A) Qualitative impairment in social interaction, as manifested by at least two of the following:

1. Marked impairments in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body posture, and gestures to regulate social interaction.
2. Failure to develop peer relationships appropriate to developmental level.

3. Lack of spontaneous seeking to share enjoyment, interests, or achievements with other people, (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people).

4. Lack of social or emotional reciprocity (note: in the description, it gives the following as examples: not actively participating in simple social play or games, preferring solitary activities, or involving others in activities only as tools or mechanical aids).

(B) Qualitative impairments in communication as manifested by at least one of the following:

1. Delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime).

2. In individuals with adequate speech, marked impairment in ability to initiate or sustain conversation with others.

3. Stereotyped and repetitive use of language, or idiosyncratic language.

4. Lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level.

(C) Restricted repetitive and stereotyped patterns of behavior, interests and activities, as manifested by at least two of the following:

1. Encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus.

2. Apparently inflexible adherence to specific, nonfunctional routines or rituals.

3. Stereotyped and repetitive motor mannerisms (e.g. hand or finger flapping or twisting, or complex whole-body movements).

4. Persistent preoccupation with parts of objects.

(II) Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years:

(A) Social interaction

(B) Language as used in social communication

(C) Symbolic or imaginative play

(III) The disturbance is not better accounted for by Rett's disorder or childhood disintegrative disorder.

Autism has become the predominant disability for which services are accessed in California. According to the most recent California Autism Report released in March 2003, cases of Type I Autism increased by **97** percent in the last four years compared to **16** percent for cerebral palsy and **29** percent for mental retardation. The same is true in other states and is well documented recently in Rhode Island, where proportionately, the one-year increase in Autism was substantially greater than the increase in all behavior disorders and disabilities combined. The only reasonable conclusion from this review is that the recent increase in Autism in the U.S. is real and significant. There is also every reason to believe that more children will be developing Autism in the coming years. Educational programs will have great difficulty coping with the flow of newly diagnosed children. In addition, when Autistic children become adults and their parents are not there, the impact on society will be even greater and the burden on the national economy will mount into the trillions of dollars (Yazbak, 2003).

c. Possible Etiologies

Control of epidemics is the responsibility of public health authorities. The Centers for Disease Control and Prevention (CDC), the central agency in charge of the nation's health, has previously played a vital role in a variety of national and international crises and programs ranging from chemical explosions in Texas City, Texas, in 1947, to family planning (1967), famine relief in Nigeria (1968), birth defects monitoring (1970), occupational safety (1973), ship sanitation (1975), and the health complications from the Mount St. Helens volcanic eruption in 1980.

Since the 1980s, the agency has become increasingly involved in promotion and regulation of **vaccines.** However, the CDC has done little to control the Autism epidemic or discover its causes. So far it has funded only three studies, and all three were epidemiologic. In the first two, both conducted in the U.S., serious increases in Autism were reported (Yazbak, 2003, Rimland, 1999, 2003).

In one, the investigators concluded that there were high rates of Autistic disorder and Autistic Spectrum Disorders in Brick Township, New Jersey, relative to rates from previously published studies. The rates from the majority of recent studies are several folds lower than the rate in Brick Township.

In the second, examining Autistic syndromes in the area near Atlanta, Ga., the authors commented, ”The overall rate (of Autism) is 10 times higher than rates from three other U.S. studies in the 1980s and early 1990s” (CDC Historical Highlights, 2003).

The primary purpose of the third study from Denmark (Yeargin-Allsopp et al, 2003) appears to be exoneration of the measles-mumps-rubella (MMR) vaccine. This vaccine contains the mercury-containing preservative Thimerosal, which the researchers suspect causes Autism, PDD or other severe developmental problems. Several methodological problems marred the Danish research and, despite the fact that there was a higher prevalence of Autism among the children who had received the MMR vaccine, the authors asserted that there was no MMR-autism connection. Moreover, the study is not relevant to the situation in the U.S. or Israel. The reason is that vaccines in Denmark have not contained Thimerosal since 1992, and Danish children received only six doses of vaccine in the first year of life. In the U.S., (and in Israel) children received 12 or more doses of vaccine before their first birthday, and many of those vaccines contained Thimerosal, including one administered in the nursery.

The Pediatrics study, "Thimerosal and the Occurrence of Autism? Negative Etiological Evidence From Danish Population-Based Data," claims to refute such a link by utilizing Danish psychiatric records to find cases of Autism. The study's premise is based entirely on a purported increase in Autism incidence in Denmark throughout the 1990s, despite removal of Thimerosal in 1992. However, the increase is not real but falsely created by the author's use of techniques which artificially boosted the number of cases identified (Geier, 2003).

Initially the authors identified Autism cases solely from hospitalization records, but in 1995 they added outpatient cases to the database. Since outpatient cases outnumbered in-patient case by 13.5 to 1 and represented 93% of all Autism cases, an appearance of an increase was created. The authors also added cases from a large clinic in Copenhagen starting in 1992, which accounted for 20% of the caseload. Previously, records from this center were excluded.

It was also discovered that two of the authors of the study work for the Danish manufacturer of Thimerosal vaccines. This conflict of interest was not disclosed by Pediatrics and the journal itself receives significant advertising revenues from vaccine manufacturers (Geier, 2003).

So far, though the CDC does not know what causes Autism and its neurological, endocrine, gastrointestinal, and immune symptoms, it appears determined, without a single clinical study of its own, to deny the potential role of MMR vaccination and mercury preservatives. The possibility that mercury may affect the immune system of certain genetically predisposed children and trigger Autism upon their exposure to MMR has never been conclusively ruled out (Yazbak, 2003).

Serious independent research is urgently needed. It cannot be expected from people with financial ties to the vaccine industry and the vaccine authorities (Geier, 2003). In addition, research should not be restricted to looking at epidemiologic data on computer spreadsheets. It must include parents' interviews and a careful examination and evaluation of the affected children. In regards to immune issues, genetic predisposition, toxic exposure, microbiological contamination, and vaccine reactions, Dr. Yazbak (2003) recommends that endoscopies and colonoscopies should be carefully performed, and biopsies of the gut wall should be tested for evidence of measles. A complete cerebrospinal spinal fluid examination including serology is needed. Serum specimens should be carefully obtained and tested for antibodies to myelin basic protein (MBP) and neuron-axon filament proteins (NAFP). Antibody levels of measles virus (MV) and human herpesvirus-6 (HHV-6) should be determined. Evaluation of serotonin, serotonin receptor antibody, interleukin-12 (IL-12), and interferon-gamma (IFN-g) levels would also be helpful. Testing for urinary indolyl-acryloylglycine (IAG) and polypeptides is of value both diagnostically and therapeutically, as it identifies those children who would benefit from **diet restrictions**. Also, checking for heavy metals is always indicated. Other appropriate testing should be individualized (Yazbak, 2003).

Emerging evidence suggests that there **is** a relationship between the MMR vaccination (Thimerosal-containing vaccines) and regressive Autism (Bernhard et al. 2001, 2002; Wakerfield, 2002). Mark and David Geier (2003) conducted a study which provides a strong epidemiological evidence for a link between increasing mercury from Thimerosal-containing childhood vaccines and neurodevelopment disorders and heart disease. In light of voluminous literature supporting the biologic mechanisms for mercury-induced adverse reactions, the presence of amounts of mercury in Thimerosal-containing childhood vaccines exceeding Federal Safety Guidelines for the oral ingestion of mercury, and previous epidemiological studies showing adverse reactions from such vaccines, a causal relationship between Thimerosal containing

childhood vaccines and neurodevelopment disorders and heart disease appears to be confirmed. It is to be hoped that complete removal of Thimerosal from all childhood vaccines will help to stem the tragic epidemic of Autism and speech disorders that the United States (and Israel) is now facing (Geier, 2003). Additional independent and unbiased clinical studies must be conducted in order to determine all causes involved, and information about the Autism epidemic and its potential causes should be widely disseminated (Yazbak, 2003).

The etio-pathogenesis of infantile Autism is still unknown, but researchers in Italy have suggested that **food peptides** might be able to determine toxic effects at the level of the central nervous system by interacting with neurotransmitters. In fact, a worsening of neurological symptoms has been reported in Autistic patients after the consumption of **milk and wheat**. The aim of the present study has been to verify the efficacy of a cow's milk free diet (or other foods which gave a positive result after a skin test) in 36 Autistic patients. Lucarelli et al. (1995) also looked for immunological signs of food allergy in Autistic patients on a free choice diet. They noticed a marked improvement in the behavioral symptoms of patients after a period of 8 weeks on an elimination diet. They found high levels of IgA antigen-specific antibodies for casein, lactalbumin and beta-lactoglobulin and IgG and IgM for casein. The levels of these antibodies were significantly higher than those of a control group, which consisted of 20 healthy children. Their results lead us to hypothesize a **relationship between food allergy and Infantile Autism** as has already been suggested for other disturbances of the central nervous system.

Many of the Autistic children have similar history of **ear infections** that were treated by **antibiotics** at least several times. The child develops a thrush or yeast infection of the mouth, because the antibiotics have killed off the normal bacteria that keep the yeast organisms in check. Prior to the recurring ear infections, the child has had a vocabulary of about 150-200 words. Following the antibiotics and the yeast infections, the child's development has begun to slow, and then regressed. The child no longer speaks, becomes extremely hyperactive, is no longer social, no longer makes eye contact, and has a disruptive sleep pattern. Shortly after starting an antifungal drug (nystatin), the child who had lost most aspects of normal development begins to improve and eye contact comes back. The hyperactivity disappears and the focus of attention improves, as well as the child's sleep pattern (Shaw, 1998).

Antibiotic use and the resulting imbalance in gut-flora is another possible cause for Autism, which will be discussed further.

d. "Total Load"

Children on the Autism spectrum have an important commonality: a huge "total load" (Rimland, 1999).

Total Load theory describes the cumulative effect of the individual assaults of each problem on the body as a whole. The cluster of symptoms that eventually leads to diagnosis of Autism arises when many systems of the body are stressed to their limits. Each child has a unique personal load limit, as does a bridge. When that limit is exceeded, a very complex constellation of problems results. Of course, not all children with these symptoms become autistic, but the more symptoms present, the more likely the child will be diagnosed with one of the labels on the continuum (Rimland, 1999). When the immune system and other physiological systems are stressed out, weakened, or being exhausted, physical symptoms show up, together with a decrease in cognitive, communication, and behavioral functions.

The following are the risk factors for Autism Spectrum Disorders (according to the ARI) (Rimland, 1999)

1. Traumatic birth.
2. Allergies in the family.
3. Dark circle under eyes ("allergic shiners").
4. Red ears or apple cheeks.
5. Fibromyalgia, chronic fatigue, or low thyroid in the mother.
6. Recurrent ear, sinus, or strep infections.
7. Chronic, unexplained fevers.
8. Respiratory problems, including asthma and bronchitis.
9. Skin problems, including eczema and poor color.
10. Digestive problems, including constipation, chronic diarrhea, or reflux.
11. History of an extended immunization reaction.
12. Sudden decline in function between 15 and 30 months.
13. Yeast infection, such as thrush.
14. Hyperactivity.
15. Agitated sleep.
16. Wild swings in mood and function.

17. Self-injurious or violent behaviors.
18. Regressive behavior after eating food with additives.
19. Sensitivity to dyes, chemicals, perfumes or medications.
20. Craving for apple juice.

The above symptoms show an extreme over load of the child's immune system. Many Autistic children suffer from most of these symptoms.

e. Abnormalities of the Digestive System

Studies by Reichelt (1990, 1991), and others have established elevated urinary excretion of peptides derived from certain proteins in milk (casein) and wheat (gluten) in children with Autism. Restriction of these proteins from their diet causes improvement in the symptoms of Autism. These proteins are broken down by enzymes in the gastrointestinal tract into peptides, and then into amino acids. The amino acids are then absorbed through the intestinal lining into the bloodstream. These peptides from gluten and casein react with opiate receptors in the brain, thus mimicking the effects of opiate drugs like heroin and morphine (gluteomorphin and caseomorphin). These compounds have been shown to react with areas of the brain such as the temporal lobes, which are involved in speech and auditory integration (Shaw, 1998). In children with Autism, the intestinal cells are damaged due to dysbiosis (frequent antibiotics kill "good" bacteria and cause an overgrowth of "bad" bacteria, which cause "leaky-gut syndrome"), and there are elevated antibodies against both milk and wheat. The major difficulty appears to be the absorption of the incompletely digested peptides. One of the reasons for the incomplete digestion may be a deficiency of enzymes that break down these peptides. Autistic children improve overall after restriction of casein and gluten (after a withdrawal phase), but slip-ups can be catastrophic, just as in drug addicts (Dr. Shaw recommends the use of Alka-Seltzer **Gold** for temporary relief from the symptoms of withdrawal) (Shaw, 1998, Rimland, 2003).

f. Organic Acid Testing (OAT)

The OAT is a simple urine test, which is used by Dr, William Shaw from "The Great Plains Laboratory, Inc." for assessment of Autistic, PDD and ADD/ADHD children. This lab test was used in this study, in order to assess the abnormal biochemical problems and treat them biologically.

Dr. Shaw described how he discovered the abnormal organic acids in Autism (Shaw, 1998). In the field of metabolic diseases, urine samples are analyzed for the chemical constituents after extracting the chemical compounds from the urine using organic solvents such as ether and ethyl acetate. The concentration of a compound in urine might be 100 times higher than in the blood. There is a consistent pattern of abnormally elevated chemicals derived from the intestinal microorganisms in the urine of Autistic children, compared with normal urine samples.

The following is a list of abnormal substances found in the OAT of Autistic children according to Shaw (1998, 2003):

1. Tartaric acid is a highly toxic substance, damaging the muscles and the kidneys, and can be fatal. It is produced by overgrown yeast (especially after using antibiotics) in the intestines, causing not only symptoms of Autism, but also depression, fibromyalgia, and chronic fatigue. Tartaric acid is also a main byproduct of the wine industry and it is used as a "safe" food additive. It is an analog of the Krebs cycle compound malic acid, which prevents the normal biochemical from completing its normal function. Tartaric acid inhibits the enzyme fumarase, which is important in the function of the Krebs cycle, where most of the body's energy is produced, and which depends on a continuous supply of malic acid. Additionally, if sufficient malic acid cannot be produced, the body cannot produce the sugar glucose, which is the main fuel of the brain, in the process of gluconeogenesis. Adults with elevated values of tartaric acid have foggy thinking, weakness and depression (Shaw, 1998).

The tartaric acid value in urine was (for example) 300 mmol/mol creatinine prior to treatment, a very abnormal value that is 20 times the median normal value (most chemicals measured in urine are divided by the urine creatinine concentration to compensate for different amounts of fluid intake in different individuals). Following

the treatment of nystatin (in this example), the level of tartaric acid, which is one of the compounds derived from yeast microorganisms, decreased considerably. The yeast are very resistant and anti-fungal treatment should continue for 6 months to 3 years, or a biochemical rebound could show up with loss of improvement. This rebound can occur also due to immune system defects.

2. Citramalic acid, is another analog of the normal compound malic acid, inhibiting the production of malic acid, and is very elevated in urine of children with Autism.

3. Arabinose is a sugar that is also found in high values in the urine of Autistic children, and it is associated with Candida overload. It is over 5 times that of normal controls (in infants, arabinose values are extremely low because there is no yeast in the intestines of a newborn baby). An Autistic child with very high level of urine arabinose had chronic hypoglycemia following antibiotic treatment for ear infection as an infant (Shaw, 1998).

Arabinose appears in apples, which can cause severe worsening of the symptoms of Autism within a short time after eating them or drinking apple juice. Arabinose may be also formed from the breakdown of the sugar glucose and antioxidants such as glutathione may inhibit this conversion. The breakdown of glucose also results in the formation of glyoxal (aldehyde), which can react with and modify protein structure. This could be the reason for demyelination, due to high arabinose, and the interference with critical function of co-enzyme vitamins, such as vitamin B-6, biotin and lipoic acid. Even when nutritional intake is adequate, there could be vitamin deficiencies due to biochemical bonds and decreased enzyme activity. Very similar changes in the brain's tissue were found in people with Alzheimer's disease and Autism. High amounts of Vitamin B-6 are very effective in preventing damage of brain's tissue, as well as glutathione, biotin and lipoic acid supplementation.

4. Yeast by-products - Candida and Yeast overgrowth, as well Clostridia of the intestinal tract, are very common in Autistic children, but are very hard to detect in typical endoscopy examination or even in stool culture. The organic acid test is valuable because it detects yeast and fungal byproducts that are made in the intestinal tract.

5. The OAT also screens for genetic illnesses and many nutritional deficiencies (see Appendix 1 for an example of the OAT).

g. Lack of lithium in Autistic children and their mothers

While a specific cause for Autism is still unknown, there are suggestions that excessive mercury or other toxic metals and/or lack of essential minerals may play a role. The amount of toxic metals and essential minerals can easily be assessed by blood, urine and hair. The EPA concluded that hair is a meaningful and representative tissue for measuring heavy metals, despite its limitations.

51 children with Autistic Spectrum Disorder - ASD - (48 with Autism, 2 with PDD, 1 with Asperger) and their mothers were studied by Adams, et al. (2003). 40 neurotypical children enrolled as a control group (ages 3-25). A hair analysis was done in a blind fashion by Doctors Data Lab. 39 toxic metals and essential minerals were evaluated, including the evaluation of the hair of mothers with children with ASD. It was found that the mothers of children with ASD had 57% more mercury in their hair on average than the typical mothers, but mercury levels did not appear abnormal in this group of children, since this was long past their primary exposure to mercury (from Thimerosal-containing vaccines, or maternal mercury exposure to fish or dental fillings). A loss of the ability to excrete mercury in young infants with Autism could be explained by the excessive use of oral antibiotics. The following essential minerals were found in the hair analysis:

1. Iodine: In ASD children, the mean level was much lower (45%) than for the control children. Iodine could be an important factor in the early development of Autism, presumably through its effect on thyroid function.
2. Lithium: ASD children had 30% lower level of lithium with statistical significance.
3. Potassium: ASD children with low muscle tone had very low level of potassium. Deficiency of these minerals could be part of the underlying cause of Autism. Supplements of iodine and lithium could be beneficial to Autistic children and getting potassium from fruit and vegetables will improve their muscle tone (Adams, et al. 2003).

Low levels of lithium were also found in ASD mothers, 40% lower than the mothers of typical children. A deficiency during pregnancy affects fetal development and especially brain development (lithium concentrations are highest in the brain, and are the highest during the first trimester. Low levels of lithium have been found to be correlated with a wide range of behavioral problems, including aggression and decreased social ability (Schrauzer, 1994). It is used in high doses for mood stabilization. Low levels of lithium were also found to affect the immunune system. Low levels in ASD mothers results in lower levels in their children, which may explain why these children suffer from ear infections in their first 3 years of life (Schrauzer, 2002). In turn, that much higher level of ear infections results in much higher oral antibiotics, which results in a temporary decrease in the ability to excrete mercury, and can also contribute to gastrointestinal problems by eliminating normal GI flora. Therefore, a low lithium level is plausible as an important factor in the etiology of Autism. Only the lithium levels were abnormal in the mothers of children with ASD. There were no other statistically significant difference in the levels of toxic metals or essential minerals between mothers of children with ASD and mothers of typical children.

These results should be investigated in a larger study to confirm the findings. These findings may be significant in terms of pointing to nutritional deficiencies (especially lithium, iodine and potassium) as a contributing factor in the etiology of Autism. Dietary supplementation with those minerals may help treat some of the symptoms of ASD. Also prenatal supplementation with lithium could possible reduce the incidence of Autism, and more investigation into maternal lithium levels in ASD is needed (Adams, et al. 2003).

h. New Treatment Options

The traditional treatments include medications, behavioral managements, and special schools that provide intense early intervention in language, motor and psychological areas. The problem with these usual interventions is that they focus on ameliorating **symptoms** rather than addressing the **underlying causes** of **Autism**. Medications can alleviate behavioral and attention-related symptoms, but often with undesirable side effects. Caring special-education teachers offer individualized programming which may fail to allow the child's own sensory systems to learn how to modulate and

integrate information. The lack of typical peers can also be problematic. Counseling programs help parents cope with issues such as picky eating and sleep problems but, again, do not speak to their causes (Gerlach, 1998).

New, exciting treatments are currently receiving recognition. They focus on reversing problems related to reduced immune system dysfunction, overexposure to antibiotics and toxins, birth trauma, and reactions to immunizations. The literature is reporting children who are recovering from Autism and PDD (Rimland, 1999, 2003).

Biological Treatment for Autism and PDD

Autism was reversed in many children because they started therapy at a very young age, but there are reports of some improvements after antifungal therapy in people in their twenties (Rimland, 1997, 2003). The major therapies for Autism are antifungal products, probiotics (Lactobacillus, acidophilus, etc. - from a dairy-free brand) to control yeast and bacteria overgrowth, immune therapies and nutritional therapies (dietary modifications).

Dr. Shaw recommends the simultaneous use of probiotic products any time an antifungal drug is used. There are antifungal products that can be ordered without a prescription, such as garlic (or garlic extract), grapefruit seed extract, oregano oil, caprylic acid (coconut oil is its major natural source) and its oil form (MCT oil), tanalbit (plant tannins), goldenseal, aloe vera gel, mastic, and lactoferrin. All these products are safe, but they may cause the **die-off** reaction that is just as severe as the one caused by prescription drugs. The child would feel worse 3-4 days after beginning the antifungal therapy. There may be symptoms of extreme tiredness, fever, bloating, nausea, vomiting, eczema, aching, headache, stuffiness, and increase in stereotypical behaviors, self-stimulating, arm flapping and hyperactivity. This reaction is due to the release of these abnormal organic acids during the yeast's die-off phase. These toxins are absorbed into the body and eventually excreted into the urine. Therefore, the concentration of abnormal urine organic acids rises when antifungal products are first given, and then begins to drop as the yeast are all killed and there are no more toxic organic acids to release. It also occurs when some of the bacterial overgrowths of the intestinal tract are treated as well (Shaw, 1998).

Diet should be changed in order to control yeast overgrowth. Crook (1996) and Shaw (1998) have addressed the importance of sugar elimination. "If it's sweet, don't eat"

rule is true even for fruit juices (but not for whole fruit, except initially). During the transition phase, they recommend to dilute fruit juice ten-fold with water, and gradually drink water only. All types of sugar, both natural and refined should be eliminated. Whole fruits may be eliminated from the diet for a month to accelerate the yeast elimination, and a supplement of vitamin C should be given to compensate.

A frequently asked question, after elimination of fruits and sugars, dairy and wheat (casein and gluten-free diet), is "what is left to eat"? Major sources of carbohydrates may include potatoes, corn, rice, beans, peas, and vegetables, such as broccoli, cauliflower, green leafy vegetables, and more. Meat and fish should be OK according to Dr. Shaw, however, there is a large amount of antibiotics, hormones and fungal byproducts in commercial meat and fish are usually contaminated by mercury. Food should be obtained from an organic source, in order to reduce exposure to these chemicals. Combining diet with antifungal therapy is very effective in controlling intestinal yeast overgrowth, as well the use of malic acid supplements to help during the die-off reaction, until the tartaric acid from the yeast is eliminated. Vitamin B-6 should be taken prior to starting antifungal therapy (Shaw 1998).

It was found that allergies can frequently be a major underlying cause of ear infection (Kontstantareas & Homatidis, 1987). Research has shown that treatment of underlying allergies diminished the recurrence of otitis media in children (Shaw, 1998) without the use of antibiotics. Research (Shaw, 1998, 2005; Rimland, 1994) has shown a relationship between frequent ear infections and antibiotic use and the development of ADD/ADHD, Autism and other developmental disorders. Unfortunately, many doctors prescribe antibiotics unnecessarily, even against viruses. These antibiotics kill the good bacteria that populate the human intestinal flora, causing dysbiosis (imbalance of intestinal flora), and the overgrowth of yeast, clostridia and other toxic bacteria. Several researchers feel that this epidemic can be stopped, and preventive ways can be used, in order to encourage the healthy development of our children (Shaw, 1998, 2005).

The following is a summary of biological treatments for Autism:

1. Dietary modifications – although initially challenging, efforts here alone can increase relatedness, attention, eye contact, and use of language – immediately and markedly. The child's diet should be unrefined, varied, and free of artificial colors,

flavors, additives, and naturally occurring salicylates (apple juice, because it contains salicylates, is to be avoided) (Shaw, 1998, Hamilton, 2000).

Special diets – The behavioral problems of many Autistic children are due to disorders of digestion, possibly of genetic or infectious origin. Often referred to as "food allergies," these difficulties are not true allergies but rather food intolerances, or brain allergies. The bigger culprits are the casein in dairy products and the gluten or gliadin in wheat, oats, and barley.

a. Gluten-free, casein-free diet. If a child is eating a diet primarily of wheat and dairy products, probably one or both of these must also be removed. Wheat gluten and casein from dairy products chemically form an opiate, which put some children into Autistic-like states. Blood tests are available to see if this is the case with an individual child (Seroussi, 2000, Reichelt, 1994).

b. Yeast-, mold-, and sugar- free diet.

All of these non-food items and problematic foods increase the toxic load on bodily systems. In addition, the use of filtered water and natural household products is recommended (Seroussi, 2000).

2. Nutritional supplementation – Nutritional aids are essential to close the gap between what these children eat and what their bodies need. They need more nutrients than typical children because of poor absorption, self-restricted diets, impaired ability to detoxify environmental chemicals and pollutants, and/or inherited nutrient deficiencies. Some supplements that have been found particularly helpful are vitamins A, B-6, calcium, and magnesium. Others showing promise are:

a. **Essential fatty acids**, taken as the oils of evening primrose, borage oil, cod-liver oil, salmon oil or flaxseed.

b. Amino acids, such as tryptophan and GABA (Werbach, 1991, Rimland, 1978).

c. Megadose vitamin B-6 (and magnesium) – 18 studies published between 1965 and 1996 by researchers in 6 countries (11 of the studies were double-blind placebo control experiments) have established beyond any reasonable doubt that vitamin B-6/magnesium treatment can significantly help about half of all Autistic children and adults. No major harmful effects have been noted, in any case (Rimland, et al, 1978). Some studies of autistic and autistic-like children showed markedly lower levels of

magnesium, calcium, copper, manganese, chromium, and other trace elements, possibly a result of poor digestion. Hair analysis and blood tests may be useful diagnosis tools for Autism, indicating poor absorption of minerals.

d. **Dimethyglycine (DMG)** – formerly called vitamin B-15, DMG is, like vitamin B-6, an extraordinarily safe nonprescription nutrient that has proven to bring about marked improvement in speech, learning, attention span, and to reduce many behavioral symptoms of autism (Rimland, 1999; Shaw, 1998).

e. **Other Supplements** -There are other over-the-counter supplements (not drugs) that show significant, although not curative, efficacy: zinc, calcium, folic acid, vitamin A, and coenzyme Q10. All have potential value in the treatment of Autism. In addition, researchers are currently investigating other factors that hold promise (Hamilton, 2000).

3. Anti-yeast treatments – The overuse of antibiotics, commonly prescribed for ear infections, seems to underline many cases of Autism. Prescribed to kill bacteria that may be causing ear infections (often caused by a virus instead), the antibiotics kill the helpful microorganisms that inhabit our intestinal tracts. In these instances, the harmful yeast Candida albicans quickly occupies the space vacated by the beneficial organisms, and begins producing alcohol-like toxins that impair brain functions. Doctors can treat the yeast with anti-fungal drugs that are not harmful. **Antifungals and probiotics**, such as Nystatin, Diflucan, (or natural alternatives) and acidophilous, are needed to reestablish intestinal integrity and to combat yeast overgrowth (Shaw, 1998). There are also natural substances against bacteria and yeast growth, such as garlic, caprylic acid, oregano oil and berberine (Shaw, 1998).

4. Miscellaneous supplements, such as **digestive enzymes** and **herbs**, which can also increase digestive function: Many digestive enzymes from safe plant sources are available as capsules (animal sources of enzymes may be more subject to contamination with bacteria or viruses). Research (Rowe, et al., 1994, Boris & Mandel, 1994) has found that the biochemical function of digestive enzymes (such as amylase and trypsin) was significantly inhibited by many common food colors. Since many Autistic children suffer from abnormality of the digestive system, this is another

good reason not to use ANY foods containing artificial food colors with Autistic as well as with ADHD children (Rimland, 1995).

5. Homeopathy – many modern healthcare practitioners believe that using this 200-year-old approach can address health imbalances in children on the Autistic Spectrum. These practitioners use natural substances that have the ability to cause symptoms in a healthy person, but cure the same symptoms in a sick person, by stimulating the body's own ability to heal itself. With this method, like cures like, whereas in traditional medicine, the opposite approach is used. There is a specific treatment for each individual, according to the homeopathic assessment (Werbach, 1991).

6. Immunotherapy – Vaccine-induced Autism is a tragic outcome of today's modern medicine. While the world's health organizations are attempting to fight epidemics of dread diseases, some of today's children are being sacrificed. The discovery of measles virus in ulcerated guts of children with autism has led to a variety of treatments that release children from the ravages of continuously high titers even years after the initial vaccine (Rimland, 2003).

7. Treatments that affect sensory processing – children with autism process what they touch, smell, taste, or see inefficiently. The sense of balance, located in the inner ear, may also be disturbed, due to repeated ear infections many of these children experienced as babies. The balance system is essential to efficient processing of sound and movement, as well as vision and language. Remediation of impaired sensory processing is essential to lessen Autistic symptoms (Rimland, 1995) :

a. Sensory Integration Therapy, provided by specially trained occupational therapists, enhances the child's ability to respond appropriately to all types of sensory input. Therapy consists of guided activities that challenge the body to make efficient, organized responses. A child is then able to pay attention, relate, sit still, organize language, and focus better (Ayres, 1985).

b. Auditory Integration Training normalizes the way children with autism process sound. Some children are oversensitive, while others are under-sensitive. The distorted messages sent to the brain impair the ability to focus on and give meaning to what is heard. Several types of AIT are available from specially trained practitioners. All utilize electronic equipment, headphones, and filtered music. This intervention

stimulates the balance, movement, and auditory systems, as well as eye movements and digestion (Rimland, 1995).

c. Vision Therapy normalizes the way children with Autism focus on and give meaning to what they see. Vision is not the same as eyesight. It is a set of abilities, learned from birth, and acquired in tandem with movement. Having both eyes move together, align, fixate, and focus as a team, enhances the ability to interpret and understand visual information. Many symptoms of autism have visual components. Visual dysfunction may result in poor eye contact and attention. A lack of binocularity could result in other autistic symptoms. Specially trained optometrists prescribe a program of movement activities and use lenses and prisms to teach the eyes how to work more efficiently (Rose, 1994).

d. Educational kinesiology, also known as Brain Gym, enhances sensory function by using specially desired movement activities (Hamilton, 2000).

8. The Son-Rise Program is an intensive therapy based on a family's loving, trusting, respectful attitude. It encourages parents to follow a child's actions while simultaneously directing him into an expanded world (Lovaas, 1998).

9. Structural Therapies – many children experienced a traumatic birth. Osteopathic physicians, health professionals trained in cranio-sacral techniques, massage therapists, chiropractors, and other body-workers can provide precise, gentle, restorative manipulative treatment. If structural dysfunction resulting from traumatic birth is corrected early, neurological development can progress satisfactorily. Then, motor, sensory-motor, social-emotional, cognitive, and behavioral problems can be averted by establishing or restoring optimal anatomic-physiologic integrity. Structural therapies can particularly benefit children who have chronic ear infections (Gerlach, 1998; Rimland, 2003).

10. "DAN!" (Defeat Autism Now!)

Recovery from Autism and PDD is now a possibility. Dr. Bernhard Rimland founded the Autism Research Institute in 1967 in San Diego, California, and is its director. He is also the founder of the Autism Society of America and the editor of the Autism Research Review International and the prize-winning book "Infantile Autism: The Syndrome and Its Implications for a Neural Theory of Behavior" (In addition, he

served as chief consultant for the film “Rain Man”). He established the assessment and treatment program for autistic children, using the Organic Acid Testing (which was discussed above), and prescribing biological as well as nutritional treatments as described above for the specific individual.

It seems like in genetically susceptible individuals, immunological and/or gastrointestinal dysfunction, as well as viral or fungal infections and metabolic imbalances, interact in intricate but plausible ways to bring about autism (or ADHD or PDD etc.). In the "DAN!” program (Defeat Autism Now!), many biological problems were identified to be at the root of autism, and a wide range of treatment approaches were developed. Most of them are safe, simple, easily implemented and do not require a prescription. The **"DAN!"** Program includes testing for a range of possible causes for autism, such as problems with organic acids, amino-acid metabolism, digetive function, heavy metal intoxication, and immune system dysfunction. **The Autism Research Institute** is sponsoring the computerized analysis of the "DAN!" Biomedical Database to increase understanding of the biology of autism, and is helping train medical practitioners interested in following this protocol.

11. Enzyme Cure

In her most recent book “Confronting Autism” (1999), Victoria Beck describes a tremendously exciting finding in autism treatment. Secretin, a digestive enzyme that was discovered in 1901 has helped many children, including Victoria’s son, Parker. He quickly began to improve in every area: language, awareness, and behavior, and his diarrhea stopped. How secretin worked for him is still a mystery, but he did get much better.

The function of secretin (a polypeptide made up of 27 amino acids) is to cause the pancreas to release bicarbonate after a meal. The stomach secrets acids after a meal, while the pancreas secrets digestive enzymes, to digest the food arriving into the small intestines from the stomach. These enzymes will not function properly if the acid from the stomach is not neutralized by bicarbonate from the pancreas. Secretin is produced by certain cells in the intestine and is stimulated by the presence of stomach acid. It is available as a drug from pig intestine, which is very similar to human’s secretin. In order to assess pancreatic function, secretin is injected into the vein and is transported by the bloodstream into the pancreas. If the pancreas functions properly, then bicarbonate will be produced by it.

Dr. Shaw (1998) described autistic children that before the secretin infusion hardly spoke 2 words, did not make eye contact and were zoned out most of the time. Within 3 weeks of the infusion, they made eye contact most of the time, spoke in short sentences, and could say 100 of words. Children with autism are not producing secretin in sufficient amounts and their digestive process is impaired as a result. Reduced secretin production may be related to gluten sensitivity or viral damage to the intestinal mucosa caused by the live virus vaccines such as MMR. Autistic children are producing a defective type of secretin that is not capable of stimulating the pancreas. It is also possible that secretin has some direct beneficial effect on brain functioning. It is also possible that auto-antibodies against the pancreas induced by Candida may be preventing the pancreas from responding to normal amount of secretin produced by the child's own body (Shaw, 1998).

Secretin may not be the "miracle cure," but its efficacy is certainly worth further research. Several studies are underway at nearly a dozen medical centers to formally evaluate the enzyme for use in autism treatment. Thus far, the results seem promising.

12. Experimental evaluations of other biomedical treatments for Autism are also in the works, including the use of intra-venous gamma globulin (IVIG) and certain orally administered supplements, known as transfer factors, designed to enhance immune function.

Biological interventions versus drug therapy

Since 1967, the Autism Research Institute has been collecting data of parent ratings of the usefulness of the many interventions tried on their Autistic children. More than 23,700 parents responded till 2005 (Rimland, 2005) on three categories regarding the behavior of their children– "made worse", "no effect" and "made better", for drugs, biomedical/non-drug/supplements, and special diets.

On the drugs column, many of the drugs were rated "got worse" more than "got better." For example: Antibiotics – 12% got better, 57% no effect, and 31% got worse; Ritalin – 29% got better, 26% no effect, and 45% got worse; Cylert – 20% got better, 35% no effect, and 45% got worse; Haldol – 34% got better, 28% no effect, and 38% got worse; Except for antifungals (nystatin) – 49% got better, 46% no effect, and 5% got worse; and Secretin (intravenous) – 48% got better, 44% no effect, and 7% got worse.

On the section of biomedical /non-drug/ supplements, there were more "got better" than "got worse." For example: Vitamin A – 41% got better, 58% no effect, and 2% got worse; DMG – 42% got better, 51% no effect, and 7% got worse; fatty acids – 55% got better, 42% no effect, and 2% got worse; detoxification (chelation) – 76% got better, 22% no effect, and 2 % - got worse; digestive enzymes – 56% got better, 42% no effect, and 3% got worse; vitamin B6 with magnesium – 47% got better, 49% no effect, and 4 % got worse; vitamin B12 – 63% got better, 33% no effect, and 4 % got worse; vitamin C – 41% got better, 57% no effect, and 2% got worse.
On the section of special diets – gluten and casein- free diet – 65% got better, 32% no effect and 3% got worse; Feingold diet – 53% got better, 45% no effect, and 3% got worse.

Relatively new studies have shown beyond doubt the efficacy of biological treatments. Audhya, et al. (2002) conducted a study of 184 Autistic children, treated by increasing doses of B6 and magnesium. 48% improved significantly, 47% improved marginally, and 5% did not show an effect on their behavior.
Kuriyama, et al. (2002) gave 16 PDD children, ages 6-16, 200mg/day vitamin B6. In a 4-week randomized double-blind placebo-controlled study, the B6 group showed 11.2 IQ points compared to 6 points for placebo (statistically significant).
Rimland and Edelson (2005) also studied the effect of vitamin B6 and magnesium on 5780 Autistic children. 47% improved their behavior significantly.

Patricia Kidd (2002, p. 472) wrote in her excellent review article about the "DAN!" Program – and the importance of treating all the biological aspects of autism: "Conventional medicine has largely failed autistic individuals and their families. Autism went through a long period during which institutions hesitated and parents struggled to find any means to help their children. Some of these parents were scientists and physicians. They carefully observed their children and built cooperative networks to share experiences. They implemented various interventions such as diet, vitamins, behavioral modification, and specialized education. As a result, autism has emerged as a model of successful integrative medicine."

Kidd (2002) summarized the clinical and laboratory findings in Autism:

1. **Congenital**: inborn errors of metabolism; prenatal susceptibilities; differing genetic load interacting with combinations of these factors.
2. **Biochemical peculiarities**: impaired sulfoxidation capacity; multiple nutritional deficits.
3. **Central Nervous System** (CNS): altered sensitivity to, and abnormal processing of, sensory and expressive information; neurotransmitter imbalances, sometimes with abnormal transmitters such as exorphin peptides.
4. **Gastrointestinal tract** (GI): impaired digestion, bowel flora alterations, food intolerances, "leaky gut" – increased permeability to poorly digested food particles, peptides, microbial toxins, and other antigenic and metabolically active substances.
5. **Liver:** impaired detoxification capacity, often with low cysteine, taurine, or glutathione levels.
6. **Immune system:** abnormal hypersensitivity; abnormal antibody- and cell-mediated processes; pro-inflammatory cytokines; autoimmune antibody imbalance (Kidd, 2002).

Kidd also discussed the important issue of chelation, which is the detoxification of heavy metals. To be conducted safely and effectively, mercury chelation is best entrusted to a qualified practitioner. Serious adverse side effects are rare but can occur, so professional monitoring and assessment is essential. For the subject to be considered for **detoxification** most physicians require**:**

1. Normal creatinine clearance.
2. No allergic reaction to a small sample of chelating agent.
3. Discontinuation of vaccines containing thimerosal.
4. Removal of mercury-containing amalgams (more of a concern with DMPS than with DMSA).
5. Vitamin, mineral, fatty acid deficiencies corrected.
6. Intestinal/GI health assessed and restored.
7. Seafood consumption cut (some sources may be allowed).
8. Casein- and gluten-free diet.

Autism remains a challenge to basic and clinical researchers. More in-depth studies are needed to clarify the relative contributions to Autism symptomatology from the perspective of: (1) genetic predispositions interacting with toxins or other etiologic triggers; (2) maternal toxic burden, maternal antibodies against the child's antigens, and prenatal contribution to autism risk; 3) interactions between immune or detoxification impairment and vaccinations; (4) pro-inflammatory cytokine imbalances in relation to anti-inflammatory nutrient status; (5) likelihood of co-synergy between the intestinal, CNS, and immune abnormalities; and (6) contribution of autoimmune mechanisms to the overall condition and prospects for controlling such mechanisms (Kidd, 2002).

C. Case Study Methodology

A case study is an ideal methodology when holistic, in-depth investigation is needed (Fiagin,Orum & Sjoberg, 1991). Case studies are designed to bring out the details from the viewpoints of the participants by using multiple sources of data. Yin (1993) has identified some specific types of case studies: exploratory, explanatory and descriptive. Stake (1995) included three others: intrinsic –when the researcher has an interest in the case; instrumental – when the case is used to understand more than obvious to the observer; collective – when a group of cases is studied.

Exploratory cases are sometimes considered as a prelude to social research. Explanatory case studies may be used for doing causal investigations. Descriptive cases require a descriptive theory to be developed before starting a project. Pyecha (1988) used this methodology in special education studies, using a pattern-matching procedure. In all of the above types of case studies, there can be single-case or multiple-case applications.

Case studies tend to be selective, focusing on one or two issues that are fundamental to understanding the system being examined. Case studies are multi-perspectival analysis, and a triangulated research strategy: data, investigators, theories and methodologies. The need for triangulation arises from the ethical need to confirm the validity of the processes. In case studies, this could be done by using multiple sources of data (Yin, 1984):

1. Data source triangulation, when the researcher looks for the data to remain the same in different contexts.
2. Investigator triangulation, several investigators examine the same phenomenon;
3. Theory triangulation, when investigators with different view points interpret the same results.
4. Methodological triangulation**,** when one approach is followed by another, in order to increase confidence in the interpretations.

The case study methodology has been criticized because of the issue of generalization: in analytic generalization, previously developed theory is used as a template against which to compare the empirical results of the case study (Yin, 1984). There are four applications for a case study model (Yin, 1994):

1. To explain complex caused links in real-life interventions.

2. To describe the real-life context in which intervention has occurred.
3. To describe the intervention itself.
4. To explore those situations in which the intervention being evaluated has no clear set of outcomes.

Single-case studies may be used to confirm or challenge a theory or to represent a unique or extreme case (Yin, 1994). Single-case studies are also ideal for revelatory cases where an observer may have access to a phenomenon that was previously inaccessible. As in all research, consideration must be given to construct validity, internal validity, external validity and reliability.

The first stage in the case study methodology is development of the case study protocol: determine the required skills and develop and review the protocol. There are 5 components of case studies (Yin, 1994):

1. A study's questions (The research questions: who, what, where, how and why).
2. Its proportions (the units of analysis could be an individual, a community, etc.).
3. Its units of analysis.
4. The logic linking the data to the proportions.
5. The criteria for interpreting the findings.

The second stage of the methodology is the conduct of the case study. There are 3 tasks:

1. Preparation for data collection.
2. Distribution of the questionnaires.
3. Conducting interviews.

A case study should use as many sources as relevant in the study (documents, interviews, observations, archival records, etc.) Not all case studies lend themselves to statistical analysis, and in fact the attempt to make the study conductive to such analysis could inhibit the development of other aspects of the study. The alternative analytic techniques: using arrays to display the data, creating displays, tabulating the frequency of events, ordering the information and other methods.

The analysis will rely on the theoretical propositions that led to the case study, or developing a descriptive framework around which the case study has been organized. Based on the findings, and evidence, the researcher develops conclusions, recommendations and implications.

This research is a case study research. The case study methodology was chosen because of the small number of subjects (20), and the nature of the project. The process for each subject was described separately and then in a collective way for the whole group.

Chapter 3

Methodology

Aim of this study

The aim of this study was to determine whether biological treatment could lead to improvement in the development and behavior of children on the neuro-behavioral spectrum.

In this study, the organic acid test in urine (OAT) was used in order to determine which biochemical factors needed to be addressed, such as nutritional deficiencies, yeast, bacteria or fungus overgrowth, and what supplemental and diet help needed to be given for the specific child.

Research question

Can a change in biological factors lead to a change in attention, communication, behavior and development of children on the neuro-behavioral spectrum, due to these biological treatments, as measured by the OAT?

Research hypotheses:

1) Bacterial dysbiosis and biochemical imbalances would be found in the OAT of children with neuro-behavioral disorders, such as elevated levels of arabinose, tartaric acid, citramalic acid and candida/yeast over growth, as compared with normal lab tests.
2) The physiological/biochemical factors would be more severe in children with greater or worse symptoms.
3) The children who follow through with the diet and treatment plan would improve on both the parents' and teacher's questionnaires.

Research method

A case study methodology was chosen for this research due to the small sample of subjects and the nature of the problems that were examined. This was a descriptive-exploratory case study research, and it was also an intrinsic and collective case study.

Research population

Twenty children participated in this study. Their parents chose to participate after hearing a lecture about biological treatment for developmental problems or reading about it in M.R.P.I's website (the FDH of Israel). One of the subjects was diagnosed with ADD, two were epileptic and the rest of the group - were PDD or autistic children. There were only 5 girls in the group. The ages ranged between 2 and 13 years old.

Research instruments

Five instruments were used in this study:

1. The Organic Acid Test in urine (OAT) was described in detail in the literature review (page 43). In order to assess the abnormal biochemical problems, urine samples were taken from the children and sent by M.R.P.I's lab to The Great Plains Laboratory, Inc. in Kansas, of Dr. William Shaw (see Appendix 1).

There are many biochemical compounds in this urine test (66 acids). The relevant substances, which appeared in many of the OATs as abnormal (too high or too low), are shown in Figure 3.1:

Normal range mmol/mol	**What does it mean**	**Compound**
0.0-2.0	Toxic substance produced by yeast/fungal in GI tract	Citramalic acid
0.0-47.0	""	Arabinose
0.0-0.5	"	3-oxoglutaric acid
0.0-16.0	"	Tartaric acid
0.0-50.0	"	Furan-2.5-dicarbopxylic
0.0-10.0	Indicates bacterial overgrowth in the GI tract	2-hydroxyphenylacetic
0.0-50.0	A tyrosine product of GI bacterial overgrowth and small bowel disease. Elevated values may be associated with celiac disease.	4-hydroxyphenylacetic
0.0-20.0	Elevated succinic acid may indicate a relative deficiency of riboflavin and/or coenzyme Q10, which are essential for the Krebs cycle function	Succinic acid
15.0-200.0	"	2-oxo-glutaric acid (alpha-ketoglutaric acid)
0.0-25.0	The enzyme needed to metabolize citric and aconitic acids (aconitase) is dependent on glutathione. If increased, glutathione supplementation is required.	Aconitic acid
180.0-560.0	High citric and aconitic acids may be due to intake of citric acid containing foods, intestinal yeast which produce citric acid or depletion of glutathione, which is required for the enzyme acotinase that metabolizes both aconitic and citric acids.	Citric acid
0.0-7.5	A dopamine metabolite, which is most commonly due to stress that increases catecolamines from the adrenal gland.	HVA

Normal range mmol/mol	What does it mean	Compound
1.0-4.7	A metabolite of epinephrine and norepinephrine, which is most commonly due to stress that increases catecholamines output from the adrenal gland.	VMA
0.0-2.0	Fatty acid metabolite. Increased suberic acid indicates increased fat in the diet.	Suberic acid
	Increases in ethylmalonic, methylsuccinic or suberic acids may be due to fatty acid oxidation disorders, carnitine deficiency, fasting or to increased intake of triglycerides. The fatty acid oxidation defects are associated with hypoglycemia, apnea episodes, lethargy and coma. Regardless of the cause, carnitine supplementation may be beneficial.	Ethylmalonic acid
20.0-115.0	Toxic indicators	Pyroglutaric acid
0.0-5.0	Vitamin indicators	Methylmalonic acid
30.0-200.0	Vitamin C -low values indicate a dietary deficiency and/or increased utilization of antioxidants.	Ascorbic acid
2.0-26.0	Is a major metabolite of vitamin B6. Low pyridoxic acid indicates low intake of vitamin B6. Vitamin B6 deficiency maybe also due to malabsorption or dysbiosis.	Pyridoxic acid
1.0-4.0	Vitamin B indicator- if it is high, there is high vitamin B intake. If it is low, there is a vitamin B deficiency	Pantothenic acid
0.0-2.0	A tryptophan metabolite that requires vitamin B6 for its further metabolism. An increase in kynurenic acid indicates a vitamin B6 defeciency.	Kynurenic acid
10.0-400.0	Is a conjugate of glycine and benzoic acid formed in the liver. Benzoic acid is a food preservative and is also present in high amounts in cranberry juice. Benzoic is also derived from byproducts of GI bacteria and the chemical solvent toluene. High values are most commonly due to dysbiosis. An exposure to toluene is mostly due to an exposure (outgassing of new carpets or glue sniffing).	Hippuric acid
0.0-100.0	High values indicate genetic disease (hyperoxalurias) or due to intestinal yeast or bacteria overgrowth.	Oxalic acid

Figure 3.1 describes some of the compounds of the OAT and their normal range according to The Great Plain laboratory, Inc.

2 A nutrition and eating habits questionnaire, adapted from Gelber (1993) (see Appendix 2). The parents were asked to write what the child eats on a regular basis, cravings, and what are his reactions to certain foods.

3. A historical and developmental questionnaire filled out by the parents (see Appendix 3).

4. Conners' scale for scanning attention, hyperactivity and impulsivity as well as learning difficulties, filled out by the teachers or caregiver (based on DSM-IV) (see Appendix 4).

5. A teacher's questionnaire for attention deficits and overactivity, adapted from Barkley (1995) (see Appendix 5).

Research Outline

1. Information about this study was published in the internet and also by lecturing and distributing papers to professionals, working with developmental disorders and to parents. This was done through the Israeli non-profit FDH (functional and dental health – M.R.P.I) Foundation (www.functional-medicine.org).
2. Parents who were interested, contacted the laboratory that was responsible for taking the OAT and sending it to the USA, and at the same time contacted the researcher and received the questionnaires.
3. Taking the Organic Acid Test (OAT) and filling the questionnaires (see Appendix 1-5).
4. Getting the results of the OAT.
5. According to these results, a consulting process has begun, through phone conversations, faxes and/or e-mails, helping the families adjust to the new life style, changing diet habits and adding the supplements.
6. Follow-up and second questionnaires after 6-12 months, depends on the time starting the procedures and the recommendations.

Additional details of research

In this research, I proposed that children with Autism, PDD, or ADD/ADHD would improve after a change in diet and appropriate biological treatment.

All the children went through a pre-treatment, using the OAT and questionnaires, and post-treatment test, only by the questionnaires. Parents and teachers were asked to fill out developmental and behavioral questionnaires (resulting in "grading" of their condition's severity), as well as nutrition questionnaires, at the time of the tests (before and after the counseling). According to the OAT results, nutritional counseling was provided, and after 6-12 months, the questionnaires were repeated. Since this research had no funding, the parents paid for the lab test themselves, and I assumed there would not be a large number of subjects because of that. Also, people would not be able to take the second test (another OAT), so we would not have a more scientific proof/evidence of the change in behavior and development, other than the questionnaires themselves.

Chapter 4

Results

A. Introduction

Twenty children participated in this case study, five girls and fifteen boys, ages 2-13. One boy had ADD, two were epileptic and the rest of the children were diagnosed with PDD or Autism. All of them took the urine Organic Acid Test, and filled out questionnaires (see Appendix). Only nine children went through the whole program (at least partially) and filled out the questionnaires after following a course of diet changes. Each one of them will be discussed separately with his/her OAT results and the developmental information and questionnaires. None of them took a second OAT. (In several cases Conners' sheet and the attention questionnaire were not filled out by the teacher). The rest of the children (eleven) did not follow through with the program because of different reasons, although they took the OAT and responded to the first stage of the questionnaires. Three of them were in the same family, where the parents could not agree on the diet changes and finally nothing was done, two could not get any cooperation from the school staff regarding the diet and gave up even at home, and two were epileptics, whose doctors resisted the diet and insisted that no supplements should be given as long as they are on medication and are not stable enough.

This chapter will be divided into two groups of case studies and three sections:

A. The 9 children who went through both stages and completed the program, and

B. The 11 children who did only the first stage and did not complete the program.

C. A comparison of the initial level of organic compounds in urine of the 20 children.

D. A comparison of the parent's rating on the developmental questionnaire**.**

E. A comparison of various parameters measured by developmental questionnaire before and after counseling.

B. Case studies

A. The following 9 children were able to follow through with at least part of the recommendations. For each child there is a table showing his/her major OAT results (highs and lows – above or under the normal range). Their progress will be shown later on figure 4.28 (according to the parental score on the developmental questionnaire before and after the program).

1. F.E. is a 5 year-old boy with PDD. He was born in a regular birth. He was not nursed, and he was fed cow's milk from his first day. He had ear infections and received antibiotics at least 3 times during his first year of life. He received all the regular immunizations and reacted to them by high fever. He also had bronchitis and was treated again by antibiotics. Just before he started the program he received antibiotics again for streptococcus.

His motor development was slow during the first year, but there was an early eye contact and early smiling. He began speaking a few words very early (at the age of 12 months), but then regressed to no speech at all. He began to speak again at the age of 4. At 5 years of age, he had motor difficulties (3 on a scale of 0-5), mild response to speech (2), problems with social interaction (4), was not independent in daily activities (4), was hypersensitive to noises (3) and had a great difficulty in learning and memory (5). He had a low attention span (23 on the Conners' scale and 11 on the teacher's form). He had been eating only pizza, pasta, cheese, bread, cakes and chicken and commercial salty snacks. He suffered from constipation and digestive problems. Figure 4.1 shows the main OAT results of F.E. as compared to the normal range.

Patient Value		Normal Range		Compound
low	high			
140.77		0.0-47.0	Yeast/ fungal	Arabinose
95.83		0.0-50.0	"	Furan-2.5-dicarbopxylic acid
14.01		1.0-4.7	Neurotransmitters	VMA
7.69		0.0-7.5	"	HVA
14.28		0.0-2.0	Fatty acid metabolites	Suberic acid
4.11		30.0-200.0	Vitamin indicators	Ascorbic acid
29.37		2.0-26.0	"	Pyridoxic acid
6.72		1.0-4.0	"	Pantothenic acid
146.92		0.0-100.0	Miscellaneous	Oxalic acid
502.77		10.0-400.0	"	Hippuric acid

Figure 4.1: The main OAT Results of **F.E**, as compared with the normal range, according to The Great Plains Laboratory, Inc.

Figure 4.1 demonstrates:

1. Yeast and fungal metabolites indicate yeast and fungal overgrowth in his digestive system.
2. Elevated HVA (a dopamine metabolite) and VMA (a metabolite of epinephrine and norepinephrine), most commonly due to stress, that increases catecholamine output from the adrenal gland.
3. Low ascorbic acid (vitamin C) indicating a dietary deficiency.
4. High pyridoxic acid indicates high recent intake of vitamin B6, which is not a problem. (Pyridoxic acid is a major metabolite of vitamin B6)
5. High pantotenic acid also indicates high recent intake of B vitamins.
6. Increased suberic acid. This may be due to fatty acid oxidation disorders, carnitine deficiency, etc.
7. Elevated oxalic acid. This may be due to genetic diseases or due to intestinal yeast or bacteria overgrowth.
8. Elevated hippuric acid. This may be due to benzoic acid (a food preservative) also derived from byproducts of GI bacteria and chemical solvent toluene (exposure due to outgassing of new carpets or recreational abuse of solvents such as glue-sniffing).

After receiving the OAT results, the counseling process was done by phone. According to the OAT results, it was recommended:

1. To begin with a gluten-free and casein-free diet.
2. To avoid sugars and yeast.
3. Add the following supplements: vitamin C (up to 4000mg per day), vitamin B complex (especially B1), carnitine (500-1000mg per day), and DHEA (5 mg every morning on empty stomach).
4. It was recommended to take water with lemon juice 5 minutes before meals (in order to reduce the oxalic acid).
5. Caprylic acid, garlic, oregano oil, etc. were recommended against yeast/fungal overgrowth in the GI tract.

The child began a gluten-free diet (his parents could not wean him off dairy). He has been taking vitamin C and complex B as well as carnitine, probiotics and multi-vitamin and mineral supplementation.

Although they followed through only with part of the recommendations, the results were impressive:

1. The most significant change was his ability to use the toilet. He became more independent within 3-4 months.
2. He has become much healthier and has stopped suffering from stomachaches or constipations.
3. He became more attentive, and his speech has improved, as well as his eye contact, social communication and his learning abilities.
4. On the Conners' sheet, the teacher rated him from 23 points to 15, which means better attention and learning.
5. On the inattention sheet – he went down from 11 to 9, and overactivity has gone down from 2 to 1 (there was no overactivity, but still there was a slight positive change).

2. B.T. is a 3 year-old boy with Autism. He was born in a natural birth and was nursed for 2 months. Then he was fed cow's milk and suffered from ear infections and colds. They began with soy milk, but he still had repeated ear infections and congestion and received antibiotics several times. He developed normally and had an intact eye contact during the first year and then lost it (3 on the scale of 0-5), and he

did not start speaking until after 3 years of age (3). He had poor social interaction (4) sleep disorders (3) and hypersensitivity to motion (2). He had poor attention (16 on Conners' and 7 on the teacher's scale). He ate various foods, dairy, meat, soy, pizza and pasta, but no vegetables at all. Figure 4.2 represents B.T.'s main OAT results compared with the normal range.

Patient Value		**Normal Range**		**Compound**
Low	**High**			
	139.66	0.0-47.0	Yeast/ fungal	Arabinose
	84.78	0.0-16.0	"	Tartaric acid
	148.73	0.0-50.0	Bacterial	4-hydroxiphenylacetic acid
	30.81	0.0-20.0	Krebs cycle	Succinic acid
	887.72	180.0-560.0	"	Citric acid
	5.98	0.0-2.0	Fatty acid metabolites	Suberic acid
5.49		10.0-200.0	Vitamin indicators	Ascorbic acid
	9.26	1.0-4.0	"	Pantothenic acid
	110.45	0.0-100.0	Miscellaneous	Oxalic acid

Figure 4.2: The main OAT results of **B.T**, as compared with the normal range, according to The Great Plains Laboratory, Inc.

Figure 4.2 demonstrates:

1. Yeast/fungal metabolites indicating overgrowth in the GI tract.
2. Increased 4-hydroxyphenilacetic, a tyrosine product of GI bacterial overgrowth and small bowel disease.
3. Elevated succinic acid. This may indicate a relative deficiency of riboflavin and/or co-enzyme Q10, which are needed for the Krebs cycle.
4. Increased citric acid. This may be due to intestinal yeast which produces citric acid or depletion of glutathione.
5. Low ascorbic acid (vitamin C) indicating a dietary deficiency.
6. High pantothenic acid. This may indicate high recent intake of vitamin B, which is not a problem.
7. Increased suberic acid. This may be may be due to fatty acid oxidation disorders and carnitine deficiency.

8. Elevated oxalic acid. This may be due to genetic diseases or due to intestinal yeast and /or bacteria overgrowth.

After receiving the OAT results, the counseling process was done by phone. There were also a few meetings for follow-up and support. The recommendations were as follows:

1. A gluten-free and casein-free diet (also ruling out celiac disease) and avoiding yeast and sugars.
2. Adding lactobacillus and acidophilus (10 billions cells per day).
3. Taking riboflavin and B complex vitamins as well as co-Q10 (50 mg per day).
4. Taking 2000-3000 mg of vitamin C per day and carnitine 500-1000 mg per day.
5. NAC (N-Acytilacystein) with alpha lipoic acid (instead of glutathione).
6. Taking lemon juice in water 5 minutes before meals in order to reduce oxalic acid.

B.T. started a diet free of gluten, casein, yeast and sugars and received probiotocs. They checked him for allergies and found him allergic to wheat. They started with the candida protocol and gave him garlic, mastix and thyme plus probiotics. They also avoided all food allergens, and maintained a clean environment as much as possible, in addition to taking vitamins B complex, vitamin C, co Q10, zinc, NAC and lipoic acid.

The results were as follows:

1. There was an immediate improvement in all areas of function (communication, behavior, eye contact and independence), within 1 month. When there was a slight deviation from the diet – there was also an immediate worsening of his behavior.
2. On the Conners' sheet – he scored from 16 points down to 8, which means better attention and learning.
3. On the attention sheet he went down from 7 to 4, and in overactivity – from 2 to 0.

3. T.U. is a 4 year-old boy with PDD. He was born in a regular birth and was not nursed, but received "remedia" formula based on cow's milk. He had several episodes

of high fever and received antibiotics several times due to ear infections. He received all the immunizations. His motor development was normal, but he had motor difficulties at the age of 4 (5 on a scale of 0-5). He started speaking at 12 months, but he had difficulty in long sentences and concepts such as time, female/male, etc. (4) social interaction is rare (5), no independence due to motor problems (4), poor eye contact (4), hyperactive behavior (5), sleep disorders (3), low attention (5), self stimulation behavior (4), tics (4) and poor learning (3). His attention and hyperactivity were rated as 44 on the Conners' scale and 12 on the teacher's attention sheet. T.U. ate more foods in the past but slowly stopped eating many kinds of foods, and his favorites were dairy, breads, corn and chicken. He suffered from digestive difficulties and stomach pains. Figure 4.3 represents the main OAT results of T.U. as compared with the normal range.

Patient Value		**Normal Range**		**Compound**
High	**Low**			
177.88		180.0-560.0	Krebs cycle	Citric acid
	3.72	0.0-2.0	Fatty acid metabolites	Suberic acid
0.85		10.0-200.0	Vitamin indicators	Ascorbic acid
	10.64	0.0-5.0	"	Methylmalonic acid
	2.45	0.0-2.0	"	Kynurenic acid

Figure 4.3: The main OAT results of the **T.U**., as compared with the normal range according to The Great Plains laboratory, Inc.

Figure 4.3 demonstrates:

1. Low citric acid. This may be due to impaired function of the Krebs cycle.
2. Low ascorbic acid (vitamin C) indicating a dietary deficiency.
3. Elevated kynurenic acid (a tryptophan metabolite that requires vitamin B6 for its further metabolism) indicating an immune abnormality.
4. Slight increase in suberic acid. This may be due to increased fat in diet.
5. Increased methylmalonic acid. This may be due to vitamin B12 deficiency.

After receiving the OAT results, the counseling was done by phone, e-mails and faxes. The recommendations were as follows:

1. Gluten-free and casein-free diet.
2. Taking vitamin C (2000-3000mg per day) and vitamin B complex (especially B6 and B12).
3. Taking acidophilus (in order to improve digestion and absorption of B12).
4. Taking DHA-EPA as well as flaxseeds in order to improve brain functions.

They gradually changed many of T.U.'s eating habits. He began with the gluten and casein free diet and has been eating whole rice, potatoes, tahini, apples, buckwheat, tomatoes etc. He started taking omega 3, but he could not tolerate the smell and taste, so he started eating grounded flaxseeds in addition to the vitamins and mineral supplementation (vitamin B complex, magnesium, vitamin C).
The results were as follows:

1. There was an immediate improvement in his speech and his communication abilities after 2 months.
2. There was a great improvement in his digestion, with no stomach pains, since he started eating more fruits and vegetables.
3. On the Conners' sheet he scored 44 points and went down to 19, which means less hyperactive behavior and better attention.
4. On the attention sheet he was rated from 12 to 9, and overactivity – from 7 to 4.

4. B.L is a 6 year-old girl with Autism**.** She was born in a cesarean operation and was nursed for 4 months. Then she was fed cow's milk "similak" formula. She received antibiotics a few times for ear infections and streptococcus and received all the regular immunizations. She ate tomatoes, apples and bananas, dairy, wheat, meat, chicken, and soy milk. She suffered a lot from constipation and stomach pains. She had mild motor difficulties (2 on a scale of 0-5), her eye contact was poor (2), low response to speech (3), poor language and comprehension (4), and poor social interaction (4). Her attention was poor, and she scored 33 on the conners' scale and 10 on the teacher's. Figure 4.4 describes B.L.'s OAT results compared with the normal range.

Patient Value		Normal Range		Compound
Low	High			
	101.7	0.0-47.0	Yeast/ fungal	Arabinose
	349.78	0.0-16.0	"	Tartaric acid
13.55		15.0-200.0	Krebs cycle	2-oxo-glutaric acid
	983.75	180.0-560.0	"	Citric acid
	5.37	1.0-4.7	Neurotransmitters	VMA
1.68		10.0-200.0	Vitamin indicators	Ascorbic acid
3.42		20.0-115.0	Toxic indicators	Pyroglutamic acid

Figure 4.4: The main OAT results of **B.L**., compared with the normal range according to The Great Plains laboratory, Inc.

Figure 4.4 demonstrates:

1. A very high degree of yeast and fungal metabolites, indicating an overgrowth in the GI tract.
2. Low 2-oxoglutaric acid indicates the need for alpha-ketoglutaric acid needed for a more functional Krebs cycle.
3. Increased citric acid due to intestinal yeast or depletion of glutathione.
4. Elevated VMA (an epinephrine and norepinephrine metabolite) due to stress, which increases catecholamine output from the adrenal gland.
5. Low ascorbic acid due to dietary deficiency of vitamin C.
6. Low pyroglutamic acid (a metabolite of glutathione) indicating glutathione deficiency due to oxidative stress or chemical exposure.

After receiving the OAT results, the counseling was done mainly by phone and e-mails, and there was also one meeting. According to the OAT results, the recommendations were as follows:

1. Gluten and casein free diet, with no sugars or yeast.
2. Adding acidophilus.
3. Taking vitamin C – up to 4000 mg a day as well as vitamin E, magnesium and zinc.
4. NAC with alpha lipoic acid instead of glutathione.

She has started with a gluten and casein free diet, added the supplements – NAC and lipoic acid, vitamin C, E, antioxidants and probiotics. Whenever she ate a dairy

product there was an immediate worsening in eye contact, attention and behavior. Now she knows exactly what is good for her. She happily eats her rice crackers with avocado and vegetables at school, and calls the regular food – "a no-no food".

The results of these changes were:

1. She suffers no more gas and stomach pains and her digestion functions are intact now.
2. The school staff in her case was very cooperative after they noticed her outstanding fast improvement (in just 2 months), and has made changes in the other children's diet as well, and reported a remarkable change in their behavior and communication. This was the only case of teachers' cooperation.
3. On the Conners' sheet she was rated from 33 to 25.
4. On the inattention sheet – from 10 to 6, and from 4 to 1 on overactivity.

5. S.A. is a 3 year-old boy with PDD. He was born in an emergency caesarean operation. He was fed cow's milk, but he could not tolerate it, so after a few months he was fed soy milk. He received the regular immunization with no special reaction, and also at least 5 antibiotic treatments. His motor development was normal, and he began speaking at 2 and half years. He had a mild problem in motor planning (3 on a scale from 0 to 5), a low response to speech (3), a great difficulty in language and speech (4), and poor social interaction (3). He has a great memory and good attention span. Figure 4.5 shows S.A.'s OAT main results compared with the normal range.

Patient Value		Normal Range		Compound
Low	High			
	126.72	0.0-47.0	Yeast/ fungal	Arabinose
4.31		15.0-200.0	Krebs cycle	2-oxo-glutaric acid
	28.45	0.0-25.0	"	Aconitic acid
3.63		10.0-200.0	Vitamin indicators	Ascorbic acid
	10.95	1.0-4.0	"	Pantothenic acid
	380.04	0.0-100.0	Miscellaneous	Oxalic acid

Figure 4.5: The OAT main results of **S.A.** compared with the normal range according to The Great Plains Laboratory, Inc.

Figure 4.5 demonstrates:

1. A high degree of yeast/fungal overgrowth in his gut.
2. Low 2-oxo-glutaric, indicates the need for alpha-ketoglutaric acid in order to improve the function of the Krebs cycle.
3. Low ascorbic acid. This may be due to dietary deficiency of vitamin C.
4. High pantothenic acid. This may be due to recent intake of vitamin B6 (no problem).
5. High oxalic acid. This may be due to genetic diseases, hyperoxalurias, or due to intestinal yeast or bacteria overgrowth.

After receiving the OAT results the counseling was done through the phone. The recommendations were as follows:

1. A gluten and casein free diet with no sugars or yeast.
2. Avoiding foods with oxalic acid.
3. Adding alpha-ketoglutaric acid.
4. Taking vitamin C up to 4000mg per day.
5. NAC and alpha lipoic acid instead of glutathione.
6. Taking garlic, oregano oil, caprilic acid and/or mastix against fungal/yeast overgrowth.

They tried avoiding foods with oxalic acid (such as spinach) and taking alpha-ketoglutaric acid and vitamin C, as well as garlic, oregano oil and caprilic acid in order to control the yeast in the GI tract. There was a serious question of a genetic problem, so the parents did not wish to make the drastic changes in his diet, but they gave him the supplements, adding DMG and L-carnosine.
Even though they followed through with just a part of the recommendations, they noticed a remarkable change in his language skills and communication. He did not have a behavioral problem.

6. **B.B**. is a 7 year-old boy with Autism. He was born on the 35th week in a caesarean operation. He is a twin and the mother had to be at complete rest and lay down most of her pregnancy in order to avoid losing the babies. He was born without the "sucking" reflex and was fed "materna" cow's milk formula. He suffered 5 years

from repeated ear infections and episodes of high fever and received large amounts of oral antibiotics and steroids. His motor development was normal. He began talking at 12 months of age, but then completely stopped. He was a very obese child and was hypoactive. He ate mainly carbohydrates and junk foods, pizza and meat and chicken, no fruits or vegetables. He suffered from diarrhea and constipation alternately. He had skin rashes, fluid retention and stomach pains (colic). He had motor difficulties (3 on a scale of 0-5), low response to speech (3), poor communication (4) and poor social interaction (4). He was restless (4), had poor attention (4), self stimulation behavior (4), tics (3) and a mild difficulty in learning and memory (2). On the Conners' scale he was rated 29 and 7 on the inattention scale. Figure 4.6 represents the main results of B.B. as compared with the normal range.

Patient Value		**Normal Range**		**Compound**
Low	**High**			
	261.89	0.0-47.0	Yeast/ fungal	Arabinose
	115.79	0.0-50.0	Bacterial	4-hydroxyphenylacetic acid
	38.32	0.0-25.0	Krebs cycle	Aconitic acid
	824.62	180.0-560.0	"	Citric acid
	12.02	1.0-4.7	Neurotransmitters	VMA
7.40		10.0-200.0	Vitamin indicators	Ascorbic acid
	2.31	0.0-2.0	'"	Kynurenic acid
	5.37	1.0-4.0	"	Pantothenic acid
	3.76	0.0-2.0	Fatty acid metabolites	Suberic acid
	142.82	0.0-100.0	Miscellaneous	Oxalic acid

Figure 4.6: the main OAT results of **B.B.,** as compared to the normal range according to The Great Plains Laboratory, Inc.

Figure 4.6 demonstrates:

1. A high level of yeast/fungal metabolites indicating an overgrowth in the GI tract.
2. Increased 4-hydroxyphenylacetic, a tyrosine product of GI bacteria associated with bacterial overgrowth and small bowel disease.
3. Increased citric and aconitic acids. This may be due to increased intake of citric acid containing foods, but also due to intestinal yeast which produce citric acid or depletion of glutathione.
4. Elevated VMA (a metabolite of epinephrine and norepinephrine), which is most commonly due to stress that increases catecholamine output from the adrenal gland.
5. Low ascorbic acid –indicating a dietary deficiency and a lack of vitamin C.
6. Low pyrdoxic acid (which is a major metabolite of f vitamin B6), indicating low intake of vitamin B6, malabsorption or dysbiosis.
7. High panthothenic acid indicates high recent intake of B vitamins.
8. Elevated kynurenic acid indicates B6 deficiency and immune abnormality.
9. Slight increase in suberic acid. This may be due to increased fat in the diet.
10. Elevated oxalic acid. This may be due to genetic disease (hyperoxalurias) or due to intestinal yeast or bacteria overgrowth.

After receiving the OAT results the counseling was given through the phone, and by faxes. The recommendations were as follows:

1. Gluten and casein free diet, with no sugars and yeast (also rule out celiac disease).
2. Taking acidophilus or other probiotics.
3. NAC and alpha lipoic acid instead of glutathione.
4. Vitamin C (up to 4000 mg per day), B complex and multi vitamin, mineral and antioxidants (including zzinc, magnesium glycinate and vitamins E, A, D) and colostrom (for strengthening the immune system).
5. DHEA (5 mg on empty stomach every morning).
6. Adding berberine against bacteria and caprilic acid, oregano oil and/or garlic against the fungal/yeast overgrowth.
7. DMG, L-carnosine, DHA – all are additional recommendations to improve brain functions.

They had a great difficulty changing B.B's diet. He would not try any new food, and his diet became even worse. They also had family problems at the same time, and could not follow through with the counseling program. They continued with some lab tests and they have found some parasites in a stool test. They gave him omega 3, enzymes and other supplements – vitamin C, zinc and probiotics. Then they took him off dairy, and now he eats more wholesome foods (such as brown rice, more vegetables, apples).

The results were as follows:

1. They reported a positive change in communication and language and more motivation in general.
2. He lost some of his overweight and he is less tired and more active.
3. This process took more time due to the family problems, but once he changed his diet, and took the supplements, there was an obvious change.

7. **P.B**. is a 5 year-old boy with Autism. He was born in a very difficult birth (a vacuum was needed). He had jaundice for a long time after his birth. He was nursed for 3 years. He received antibiotics 4 times in the last 4 years. His motor development was a little slow compared to normal (he started walking at 19 months). He began talking at 14 months, but then a regression was noticed. He spoke only a few words at the time of the beginning of the project. He was hyposensitive, and needed a lot of stimulation, touching everything, biting himself, and rocking himself for a long time. His hearing is impaired. He had motor problems (5 on a scale of 0-5), poor eye contact (3), poor response to speech (4), poor social interaction (in the past he was very social and then shut off – 4), he had difficulties in activities of daily living (5) and poor attention (4). He was also restless (5) and hyperactive (4) as well as having poor memory and learning (4). He ate only bread and cheese, chocolate and cornflakes. He would stay hungry and will not touch a food he did not like. The teacher's questionnaires were not filled out. Figure 4.7 represents the main OAT results of P.B. compared with the normal range.

Patient Value		**Normal Range**		**Compound**
Low	**High**			
	177.44	0.0-47.0	Yeast/ fungal	Arabinose
	20.19	0.0-20.0	Krebs cycle	Succinic acid

27.96	0.0-25.0	"	Aconitic acid
12.02	1.0-4.7	Neurotransmitters	VMA
8.60	0.0-7.5	"	HVA
2.56	0.0-2.0	Fatty acid metabolites	Suberic acid
4.67	0.0-2.0	Vitamin indicators	Kynurenic acid
142.90	0.0-100.0	Miscellaneous	Oxalic acid

Figure 4.7: The main OAT results of **P.B**. compared with the normal range according to The Great Plains Laboratory, Inc.

Figure 4.7 demonstrates:

1. Elevated yeast/fungal metabolites indicating an overgrowth in the GI tract.
2. Elevated succinic acid indicates a deficiency of riboflavin and/or coenzyme Q10, which are essential for the Krebs cycle function.
3. Increased aconitic acid. This may indicate abnormality in producing glutathione.
4. Elevated HVA and VMA, most commonly due to stress that increases catecholamine output from the adrenal gland.
5. Low normal ascorbic acid indicates a low intake of vitamin C.
6. Elevated kynurenic acid indicates vitamin B6 deficiency.
7. Slight increase in suberic acid. This may be due to increased fat in diet.
8. Elevated oxalic acid. This may be due to genetic diseases or due to intestinal yeast or bacteria overgrowth.

After receiving the OAT results they had received the counseling through the phone. The recommendations were as follows:

1. Gluten and casein free diet, with no yeast or sugars.
2. Adding vitamin C (up to 4000 mg per day) vitamin B complex.
3. Taking probiotics.
4. Taking coenzyme Q10.
5. DHEA (5 mg on empty stomach in the morning).
6. Lemon juice in water 5 minutes before meals.

They started to avoid dairy, but P.B. had difficulties keeping up with the diet, since he stayed at school everyday until 17:30 and there was no cooperation from school. There were several relapses and then an improvement again, after they have given

him vitamin C, zinc, omega 3, probiotics, enzymes and multivitamins. His diet remained very limited as before. Lately they have noticed a remarkable improvement in his communication skills, motor functions and motivation. But it took almost 7 months until they began implementing the program seriously.

8. C.H. is a 4 year-old boy with PDD. He was born in a vacuum birth. He nursed 3 months, and then was fed cow's milk formula ("materna"). He suffered from repetitive eye infections and received an antibiotic cream for a long time. He developed normally but his speech was impaired (echolalia and repetitions of everything he heard). He was not potty trained yet. He ate wheat, meat, yeast, dairy, corn and pizza. Eye contact was poor (2 on a scale of 0-5), language and comprehension was impaired (3), poor social interaction (3), and a little hypersensitivity (1). His motivation was high, and there were no difficulties in attention or hyperactivity (6 on Conners' scale and 0 on the teacher's sheet). Figure 4.8 shows the main OAT results of C.H. as compared with the normal range.

Patient Value		**Normal Range**		**Compound**
Low	**High**			
	67.26	0.0-50.0	Bacterial	4-hydroxyphenylacetic
	20.43	0.0-20.0	Krebs cycle	Succinic acid
14.72		20.0-115.0	Toxic indicators	Pyroglutamic acid
1.79		10.0-200.0	Vitamin indicators	Ascorbic acid
1.43		2.0-26.0	"	Pyridoxic acid
0.32		1.0-4.0	"	Pantothenic acid

Figure 4.8: The main OAT results of **C.H**. compared with the normal range according too The Great Plains Laboratory, Inc.

Figure 4.8 demonstrates:

1. Increased 4-hydroxyphenylacetic, a tyrosine product of GI bacteria associated with bacterial overgrowth and small bowel disease (elevated values may indicate celiac disease).
2. Elevated succinic acid. This may indicate a relative deficiency of riboflavin and/or coenzyme Q10, which are needed in the Krebs cycle.
3. Low ascorbic acid indicates a dietary deficiency of vitamin C.

4. Low pyridoxic acid indicates low intake of vitamin B6, malabsorption or dysbiosis.
5. Low pantothenic indicates low intake of pantothenic acid (vitamin B), malabsorption or dysbiosis.
6. Decreased pyroglutamic acid (a metabolite of glutathione, which is an antioxidant, removing toxins such as mercury and toxic chemicals). Low values indicate glutathione deficiency due to oxidative stress or chemical exposure.

After receiving the OAT results the counseling, which was given by the phone. The recommendations were as follows:

1. Gluten and casein free diet and avoiding sugars, artificial colors and preservatives.
2. Adding vitamin C, B complex and coenzyme Q10.
3. Multivitamin and antioxidants.
4. Acidophilus and lactobacillus.
5. Candibactin and berberine against the bacteria overgrowth.
6. NAC and alpha lipoic acid instead of glutathione.
7. DMG, DHA and L-carnosine for improvement of brain functions.

C.H. began with the GFCF diet and received the supplements. He started taking NAC and alpha lipoic acid, B complex, DMG and DHA, probiotics (acidophilus, lactobacillus), L-carnosine and chewable multivitamin. Also, oregano oil, berberin and candibactin, were given to him against the bacteria in his gut.

The result of these changes was a remarkable improvement in all areas of function, which was noticed after a relatively short time (1-2 months after the change in diet and beginning of the supplements).

9. T.M is a 3 year-old boy with PDD. He was born in a difficult birth. He was nursed for 6 months but also received cow's milk from 2 months on. He was healthy until 18 months of age, and his development was normal, and then suffered from bronchitis, pneumonia and many illnesses, and received antibiotics at least 8-9 times.

He developed well with good eye contact and communication, but after each immunization they noticed a regression in his behavior. He lost eye contact, and became restless. He had a slight motor difficulty (1), mild eye contact (2), poor social interaction (3), and they could not potty-train him (2).

He was very sick during the last year (pneumonia) and received antibiotics just before the project began. Figure 4.9 represents the main OAT results of T.M. compared with the normal range.

Patient Value		Normal Range		Compound
Low	High			
	158.43	0.0-47.0	Yeast/ fungal	Arabinose
	2.59	0.0-2.0	"	Citramalic acid
	87.28	0.0-50.0	"	Furan-2.5-dicarboxylic acid
	136.18	0.0-80.0	"	5-hydroxymethyl-2-furoic acid
	100.37	0.0-100.0	Glycolysis	Lactic acid
90.57		180.0-560.0	Krebs cycle	Citric acid
	6.68	1.0-4.7	Neurotransmitters	VMA
	3.16	0.0-2.0	Fatty acid metabolites	Suberic acid
18.39		20.0-115.0	Toxic indicators	Pyroglutamic acid

Figure 4.9: The main OAT results of **T.M**. compared with the normal range according to The Great Plains Laboratory, Inc.

Figure 4.9 demonstrates:

1. Elevated yeast/fungal metabolites indicating an overgrowth in the GI tract.
2. Low citric acid due to impaired function of the Krebs cycle.
3. Elevated VMA, which is most commonly due to stress that increases catecholamine output from the adrenal gland.
4. Low normal ascorbic acid, indicating a low intake of vitamin C.
5. Slight increase in suberic acid. This may be due to increased fat in the diet.
6. Increased lactic acid. This may be due to bacterial overgrowth of the GI tract, poor perfusion or anemia.
7. Decreased pyroglutamic acid (a metabolite of glutathione) indicating glutathione deficiency due to oxidative stress or chemical exposure.

After receiving the OAT results counseling was done through the phone. The recommendations were as follows:

1. Gluten and casein free diet, and avoiding yeast and sugars.
2. Probiotics.
3. NAC and alpha lipoic acid instead of the glutathione.
4. Caprilic acid, oregano oil and/or garlic against the fungal/yeast overgrowth.
5. Vitamin C, E, zinc, magnesium and multivitamin, minerals and antioxidants.

T.M. started a casein-free diet, and received probiotics, vitamin C and E. He could not stop eating foods containing gluten and they had difficulties following through with the rest of the recommendations. However, according to the parents' report, after 6 months, he is now functioning as a normal child of his age, with no problems in communication or language.

All these 9 children took both the pre-test and the post-test, so we could have the results of the parents' ratings (before and after) and the outcome of the (partial) biological treatment program. These will be shown later in Figure 4.28.

B. The following 11 (from 10-20) children went through the first stage of the project only (the OAT and the questionnaires):

10. G.M. is a 4 year-old boy with Autism. He was born in a difficult birth. His mother was sick during the pregnancy. He had jaundice after birth. He was nursed for 7 months, but received also cow's milk at the same time. He was hospitalized due to dehydration several times and also received antibiotics at least twice or 3 times a year. He was very sensitive and got sick very often. His development was slow but normal. He began talking at 18 months. He was hypersensitive to noises (2 on a scale of 0 to 5), he had motor problems (3), his language and comprehension was poor (4) and so was his social interaction (3). He had Tics (4), and self stimulation behavior (4). Figure 4.10 shows the main OAT results of G.M. compared with the normal range.

Patient Value		Normal Range		Compound
Low	High			
	25.37	0.0-25.0	Krebs cycle	Aconitic acid
	753.63	180.0-560.0	Krebs cycle	Citric acid
	12.11	1.0-4.7	Neurotransmitters	VMA
	3.73	0.0-2.0	Fatty acid metabolites	Suberic acid
1.92		10.0-200.0	Vitamin indicators	Ascorbic acid
0.89		2.0-26.0	"	Pyridoxic acid
	2.06	0.0-2.0	Miscellaneous	Glutaric acid
	176.20	0.0-100.0	"	Oxalic acid

Figure 4.10: The main OAT results of **G.M**. compared with the normal range according to The Great Plains Laboratory, Inc.

Figure 4.10 demonstrates:

1. Increased citric and aconitic acids. This may be due to increased intestinal yeast, which produces citric acid or depletion of glutathione.
2. Elevated VMA (a metabolite of epinephrine and norepinephrine) which is most commonly due to stress that increases catecholamine output from the adrenal gland.
3. Low ascorbic acid indicating vitamin C deficiency.
4. Low pyridoxic acid, indicates low intake of vitamin B6, malabsorption or dysbiosis.
5. Slight increase in suberic acid. This may be due to increased fat in diet.
6. Increased glutaric acid. This may be due to oxidation defects, riboflavin deficiency or metabolic effects of valporic acid (in 10% of children with Autism).
7. Elevated oxalic acid. This may be due to genetic diseases or due to intestinal yeast or bacteria overgrowth.

They received the first phone counseling session with the OAT results, and then "disappeared".

11. Z.K. is a 12 year-old boy with ADD. He was born in caesarean operation and was not nursed. He was fed cow's milk. He received antibiotics at least twice or 3 times a year throughout his life for different reasons. His development was normal

and other than speech slight problem (changing the order of the syllables in the word) there was nothing significant. His main problem was poor attention span (4) and no motivation for school work. His rating on the Conners' scale was 38 and on the teacher's sheet – 14. He ate only pizza, spaghetti and hamburgers. Figure 4.11 shows Z.K.'s main OAT results compared with the normal range.

Patient Value		Normal Range		Compound
Low	High			
	65.83	0.0-47.0	Yeast/ fungal	Arabinose
	2.29	0.0-2.0	"	Citramalic acid
	898.04	180.0-560.0	Krebs cycle	Citric acid
	6.45	1.0-4.7	Neurotransmitters	VMA
0.09		10.0-200.0	Vitamin indicators	Ascorbic acid
1.69		2.0-26.0	"	Pyridoxic acid
	4.78	0.0-2.0	Fatty acid metabolites	Suberic acid
	138.80	0.0-100.0	Miscellaneous	Oxalic acid

Figure 4.11: The main OAT results of **Z.K**. compared with the normal range according to The Great Plains Laboratory, Inc.

Figure 4.11 demonstrates:

1. Elevated yeast/fungal metabolites indicating a yeast/fungal overgrowth in his GI tract.
2. High citric acid due to intestinal yeast which produces citric acid or depletion of glutathione.
3. Increased VMA, a metabolite of epinephrine and norepinephrine which is most commonly due to stress that increases catecholamine output from the adrenal gland.
4. Low ascorbic acid indicates a dietary deficiency of vitamin C.
5. Low pyridoxic acid indicates low intake of vitamin B6 or a deficiency due to malabsorption or dysbiosis.
6. Slight increase in suberic acid. This may be due to increased fat in the diet.
7. Elevated oxalic acid. This may be due genetic diseases or due to intestinal yeast or bacteria overgrowth.

There were a few counseling sessions through the phone, trying different approaches, but there was no cooperation on the boy's side. He resisted any change in his diet and even taking the supplements was too difficult for him.

12. **Z.R** is a 4 year-old girl with PDD-NOS. She was born in a natural difficult birth, after a difficult pregnancy. The mother was ill and received a large amount of antibiotics during pregnancy and there were also some bleedings. Z.R. was nursed for 8 months and then was fed "similac" (soy milk). She received all the regular immunizations. Her motor development was normal and she began talking at 12 months of age, and had quite a few words, but then speech disappeared and began again just at the age of 3. She put everything in her mouth, chewing on cardboard, paper, plastic, etc. she was disgusted by foods such as fruits and vegetables, and ate dairy, eggs, breads, cornflakes, chicken and corn. Her parents rated motor problems (2 on a scale of 0-5), poor eye contact (3), language and comprehension (4), difficulty in social interaction (4). She had mainly communication problems. She was rated 20 on the Conners' and 8 on the inattention sheet. Figure 4.12 represents the main OAT results of Z.R. compared with the normal range.

Patient Value		Normal Range		Compound
Low	High			
	81.54	0.0-47.0	Yeast/ fungal	Arabinose
	99.20	0.0-20.0	Krebs cycle	Succinic acid
	47.97	0.0-25.0	"	Aconitic acid
	827.42	180.0-560.0	"	Citric acid
	11.85	1.0-4.7	Neurotransmitters	VMA

10.67	0.0-10.0	"	HVA
1.86	10.0-200.0	Vitamin indicators	Ascorbic acid
2.19	0.0-2.0	"	Kynurenic acid
20.38	0.0-2.0	Fatty acid metabolites	Suberic acid
138.80	0.0-100.0	Miscellaneous	Oxalic acid

Figure 4.12: The main OAT results of **Z.R**. compared with the normal range according to The Great Plains Laboratory, Inc.

Figure 4.12 demonstrates:

1. Elevated yeast/fungal metabolites indicating a yeast/fungal overgrowth in the GI tract.
2. Elevated succinic acid indicates a relative deficiency of riboflavin and /or coenzyme Q10, essential for the Krebs cycle.
3. Elevated HVA and VMA due to stress that increases catecholamine output from the adrenal gland.
4. Low ascorbic acid indicates a dietary deficiency of vitamin C.
5. Elevated kinurenic acid, a triptophan metabolite that requires vitamin B6 for its further metabolism. The increase may indicate vitamin B6 deficiency.
6. Increased suberic acid. This may be due to fatty acid oxidation disorders and/or carnitine deficiency.

They received the first counseling with the OAT results and then "disappeared".

13. **T.B**. is an 8 year-old girl with epilepsy (partial complex seizure). She has been treated with Tegratol 200 mg X3 a day. She has also a hormonal disorder and put a lot of weight lately. She was born in a cesarean operation after a healthy pregnancy. She was nursed for 3 months and then was fed soy based formula ("materna"). Her development was completely normal in all areas, including speech. There were no problems in learning or in attention or communication (3 on Conners' and 1 on the teacher's sheet). The parents' rating was also 0-1 in all areas. Her main problem was the seizures disorder, which the neurologist could not stabilize by medications and resisted any change in diet or supplementation. Figure 4.13 shows T.B.'s main OAT results compared with the normal range.

Patient Value		Normal Range		Compound
Low	High			
	113.64	0.0-47.0	Yeast/ fungal	Arabinose
23.95		10.0-200.0	Vitamin indicators	Ascorbic acid
	4.33	0.0-2.0	Fatty acid metabolites	Suberic acid
	428.13	10.0-400.0	Miscellaneous	Hippuric acid

Figure 4.13: The main OAT results of **Z.R**. compared with the normal range according to The Great Plains Laboratory, Inc.

Figure 4.13 demonstrates:

1. Elevated yeast/fungal metabolites indicating yeast/fungal overgrowth in the GI tract.
2. Low normal ascorbic acid indicates low intake of vitamin C.
3. Slight increase in suberic acid. This may be due to increased fat in diet.
4. Elevated hippuric acid. This may be due to benzoic acid from byproducts of GI bacteria and the chemical solvent toluene, due to dysbiosis or due to exposure (outgassing of new carpeting, etc.).

There were several phone-counseling sessions and one meeting, but no follow-up, due to her neurologist's resistance to the program.

14. **Y.P** is a 13 year-old boy with epileptic seizures. He has been treated by Keppra 1000mg and Trileptin 900mg. He was born in a difficult birth and was nursed only a month and then was fed sesame milk (he has been sensitive to cow's milk). He received the regular immunizations and after the last shot he had his first seizure. This has been his main problem. He was sensitive to certain smells, and has a slight difficulty in language and comprehension (1). On memory and learning he was rated as 3 (mild difficulty). He was eating a lot of soy products and other beans, turkey and eggs. Figure 4.14 represents Y.P.'s main OAT results compared with the normal range.

Patient Value		Normal Range		Compound
Low	High			
10.12		20.0-115.0	Toxic indicators	Pyroglutamic acid

5.83	1.0-4.7	Neurotransmitters	VMA
1.58	10.0-200.0	Vitamin indicators	Ascorbic acid
1.49	2.0-26.0	"	Pyridoxic acid
0.38	1.0-4.0	"	Pantothenic acid
607.66	10.0-400.0	Miscellaneous	Hippuric acid

Figure 4.14: The main OAT results of **Y.P**. compared with the normal range according to The Great Plains Laboratory, Inc.

Figure 4.14 demonstrates:

1. No bacteria or fungus overgrowth.
2. Elevated VMA due to stress that increases catecholamine output from the adrenal gland.
3. Low ascorbic acid indicating a dietary deficiency of vitamin C.
4. Low pyridoxic acid. This may be due to low intake of vitamin B6, also may be due to malabsorption or dysbiosis.
5. Low pantothenic acid indicates low intake of B vitamins, malabsorption or dysbiosis.
6. Elevated hippuric acid indicates output of benzoic acid from the chemical solvent toluene. Exposure may be due to medications or new carpeting, glue-sniffing, etc.
7. Decreased pyroglutamic acid (a metabolite of glutathione, which removes toxins from the body). Low values may indicate glutathione deficiency due to oxidative stress or chemical exposure.

They received the first phone counseling about the OAT results, but there was no teachers scores and no follow up (partially due to their physician's resistance).

15. S.R is a 5 year-old boy with PDD - Asperger**.** He was born in a vacuum birth, and was nursed for 3 months. They tried cow's milk, but he suffered from rash so they gave him soy milk. He has been treated by steroids for atopic dermatitis, which began after his first immunization at 2 months of age. He developed normally but his main difficulties were in speech, which was repetitive and echolalic. Social communication has been difficult (4 on a scale of 0-5), poor attention (4) and sleep

disorders (3). On Conners' scale he was rated 19 and on the teacher's sheet -7. Figure 4.15 represents the main OAT results of S.R. compared with the normal range.

Patient Value		Normal Range		Compound
Low	High			
0.10		1.0-4.7	Neurotransmitters	VMA
0.00		10.0-200.0	Vitamin indicators	Ascorbic acid
0.49		1.0-4.0	"	Pantothenic acid

Figure 4.15: The main OAT results of **S.R**. compared with the normal range according to The Great Plains Laboratory, Inc.

Figure 4.15 demonstrates:

1. Low ascorbic acid indicating a dietary deficiency of vitamin C and increased utilization of antioxidants.
2. Low pantothenic acid indicates low intake of B vitamins, dysbiosis or malabsorption. These results are outstandingly abnormal compared to the other tests, since everything is so low (even the VMA is lower than the norm).

There was one phone session about the OAT results and beginning of the recommendations, but they "disappeared."

16. Y.R is a 3 year-old boy with PDD. He was born in a natural birth and was nursed for 3 months. He was fed soy milk. He was treated by antibiotics several times for repeated ear infections. He has been sensitive to touch and noises and needed a lot of vestibular stimulation. Most of his rating was very severe: Motor problems (4), difficulty in eye contact (3), response to speech (5), language and comprehension (5), social communication (5), attention problems (5), hyperactivity (5), self stimulation (5). On the Conners' scale he was rated 20 and the inattention sheet - 5. Figure 4.16 represents the main OAT results of Y.R. compared with the normal range.

Patient Value		Normal Range		Compound
Low	High			
4.31		15.0-200.0	Krebs cycle	2-oxo-glutaric acid
	7.26	1.0-4.7	Neurotransmitters	VMA

0.65	20.0-115.0	Toxic indicators	Pyroglutamic acid
4.52	1.0-4.0	Vitamin indicators	Pantothenic acid
2.53	0.0-2.0	Fatty acid metabolites	Suberic acid
248.20	0.0-100.0	Miscellaneous	Oxalic acid
2.60	10.0-400.0	"	Hippuric acid

Figure 4.16: The main OAT results of **Y.R**. compared with normal range according to The Great Plains Laboratory, Inc.

Figure 4.16 demonstrates:

1. Low 2-oxoglutaric (also called alpha-ketoglutaric acid).
2. Elevated VMA, a metabolite of epinephrine and norepinephrine, which is most commonly due to stress that increases catecholamine output from the adrenal gland.
3. High pantothenic acid indicates high recent intake of vitamin B (no problem).
4. Slight increase in suberic acid. This may be due to increased fat in the diet.
5. Elevated oxalic acid. This may be due to genetic diseases, or due to intestinal yeast or bacteria overgrowth.
6. Low hippuric acid. This may be due to oral antibiotics or due to depletion of glycine by competing detoxification reactions after aspirin or in fatty acid oxidation disorders.
7. Decreased pyroglutamic acid (a metabolite of glutathione) indicates glutathione deficiency due to oxidative stress or chemical exposure.

There was one phone session about the OAT results, and there was no follow-up.

17. N.M is a 3 year-old girl with Autism. She was born in a cesarean operation, was not nursed and was fed cow's milk based formula (remedia). She was treated once with antibiotics. She developed normally except from her speech. She does not speak at all. Her eye contact was poor (4 on a scale of 0-5), response to speech (4), language and comprehension (5), social interaction (4), poor attention (4), hyperactivity (3) and her learning and memory is impaired (3). She ate only carbohydrates and sweets, dairy, and no fruit or vegetables. Figure 4.17 represents N.M.'s OAT results compared with the normal range.

Patient Value		**Normal Range**		**Compound**
Low	**High**			

111.40	0.0-47.0	Yeast/ fungal	Arabinose
40.76	0.0-20.0	Krebs cycle	Succinic acid
30.69	0.0-25.0	"	Aconitic acid
588.42	180.0-560.0	"	Citric acid
8.41	20.0-115.0	Toxic indicators	Pyroglutamic acid
6.92	0.0-5.0	Vitamin indicators	Methylmalonic acid
5.87	10.0-200.0	Vitamin indicators	Ascorbic acid

Figure 4.17: The main OAT results of **N.M**. compared with the normal range according to The Great Plains Laboratory, Inc.

Figure 4.17 demonstrates:

1. Elevated yeast/fungal metabolites, indicating yeast/fungal overgrowth in the GI tract.
2. Elevated succinic acid may indicate a relative deficiency of riboflavin and coenzyme Q10 which are needed for the Krebs cycle.
3. Increased citric and aconitic acid. This may be due to intestinal yeast which produces citric acid or depletion of glutathione.
4. Low ascorbic acid indicates a dietary deficiency of vitamin C.
5. Increased methylmalonic acid. This may be due to vitamin B12 deficiency, defective absorption or transport of B12.
6. Decreased pyroglutamic acid (a metabolite of glutathione) indicates glutathione deficiency due to oxidative stress or chemical exposure.

They received one phone counseling session with the OAT results, and there was no follow-up. Although I tried to make contacts, they were skeptical and said their doctor does not believe in this and were not interested in further contact.

18. **N.S.** is a 5 year-old boy with PDD. He was born in a vacuum birth and was nursed only one month. He was fed cow's milk and received antibiotics several times. He developed normally during his first year. His main difficulty was in communication (4 on a scale of 0-5), language (3), attention (4), hypersensitivity to noises (2), self stimulation behavior (5), tics that change from time to time (3). He ate dry snacks, dairy products and sweets. Figure 4.18 shows the main OAT results of N.S. compared with the normal range.

Patient Value		Normal Range		Compound
Low	High			
	169.33	0.0-47.0	Yeast/ fungal	Arabinose
	3.01	0.0-2.0	"	Citramalic acid
	0.80	0.0-0.5	"	3-oxoglutaric acid
	13.33	1.0-4.7	Neurotransmitters	VMA
	10.78	0.0-7.5	"	HVA
0.00		10.0-200.0	Vitamin indicators	Ascorbic acid
	8.78	0.0-2.0	Fatty acid metabolites	Suberic acid
	401.37	0.0-100.0	Miscellaneous	Oxalic acid
	556.53	10.0-400.0	"	Hippuric acid

Figure 4.18: The main OAT results of **N.S**. compared to normal range according to The Great Plains Laboratory, Inc.

Figure 4.18 demonstrates:

1. High level of yeast/fungal metabolites indicating yeast/fungal overgrowth in the GI tract.
2. Elevated HVA and VMA due to stress that increases catecholamine output from the adrenal gland.
3. Low ascorbic acid indicates dietary deficiency of vitamin C.
4. Increased suberic acid. This may be due to fatty acid oxidation disorders and/or carnitine deficiency.
5. Elevated oxalic. This may be due to genetic diseases or due to intestinal yeast or bacteria overgrowth.
6. Elevated hippuric acid indicates benzoic acid derived from byproducts of GI bacteria and the chemical solvent toluene (exposure could be from new carpets, glue-sniffing, etc.).

There was no follow-up after the first session with the OAT results.

19. I.F. is a 4 year-old boy with PDD. He was born in a vacuum birth and had jaundice after birth. He was nursed 8 months and at the same time received both soy and cow's milk formulas alternately ("similak"). He suffered a lot from constipation since his first day. He received antibiotics for pneumonia several times. He developed normally as well as speech. There was hypersensitivity to touch, noises and motion (3), sometimes did not respond when talked to (1), there were some motor planning difficulties (3), difficulty in communication (3), sleep disorders (3) and self stimulation behavior (2). Figure 4.19 shows the main results of the OAT of I.F. compared with normal range.

Patient Value		Normal Range		Compound
Low	High			
19.14		20.0-115.0	Toxic indicators	Pyroglutamic acid
7.62		10.0-200.0	Vitamin indicators	Ascorbic acid
0.75		1.0-4.0	"	Pantothenic acid

Figure 4.19: The main OAT results of **I.F** compared with the normal range according to The Great Plains Laboratory, Inc.

Figure 4.19 demonstrates:

1. Low ascorbic acid indicating dietary deficiency of vitamin C.
2. Low pantothenic acid indicates low intake of vitamin B, malabsorption or dysbiosis.
3. Decreased pyroglutamic (a metabolite of glutathione). Low values may indicate glutathione deficiency due to oxidative stress or chemical exposure.

They did a stool test and received counseling regarding E-coli, in addition to the interpretation of the OAT, and then lost contact and could not be reached.

20. R.R. is a 1 year and 10 months old girl (2 of her brothers are PDD and Autistic). She was born in a natural birth, after some bleedings during pregnancy. She was nursed 2 months and then was fed cow's milk. She was not immunized because her mother read about the relationships between immunizations and Autism. Her development has been normal. There has been a problem with eye contact and

eye tracking. She had an eye surgery and has been using glasses. She was restless and hypersensitive and had a lot of digestive problems and diarrhea. Figure 4.20 shows the main results of the OAT of R.R. compared with the normal range.

Patient Value		Normal Range		Compound
Low	High			
	2.95	0.0-2.0	Yeast/ fungal	Citramalic acid
	54.20	0.0-47.0	Yeast/ fungal	Arabinose
	72.18	0.0-50.0	Bacterial	4-hydroxyphenylacetic acid
	92.97	0.0-20.0	Krebs cycle	Succinic acid
	35.94	0.0-25.0	"	Aconitic acid
9.27		10.0-200.0	Vitamin indicators	Ascorbic acid
3.79		0.0-2.0	"	Kynurenic acid
	36.79	2.0-26.0	"	Pyridoxic acid
	10.45	1.0-4.0	"	Pantothenic acid
	4.91	0.0-2.0	Fatty acid metabolites	Suberic acid
	7.59	0.0-5.0	"	Methylsuccinic acid
	15.47	0.0-10.0	"	Ethylmalonic acid
	423.34	0.0-100.0	Miscellaneous	Oxalic acid

Figure 4.20: The main OAT results of **R.R.** compared with the normal range according to The Great Plains Laboratory, Inc.

Figure 4.20 demonstrates:

1. Elevated yeast/fungal metabolites indicating yeast/fungal overgrowth in the GI tract.
2. Increased 4-hydroxyphenylacetic, a tyrosine product of GI bacteria associated with bacterial overgrowth and small bowel disease.
3. Elevated succinic acid. This may indicate deficiency of riboflavin and coenzyme Q10, essential for the Krebs cycle.
4. Increased aconitic acid. This may indicate glutathione deficiency and the need to add reduced glutathione as a supplement.
5. Low ascorbic acid indicates a dietary deficiency of vitamin C.
6. High pyridoxic acid indicates recent intake of vitamin B6 (no problem).
7. High pantothenic acid indicates high recent intake of B vitamins.
8. Elevated kinurenic acid (a triptophan metabolite) indicates B6 deficiency.

9. Increases in ethylmalonic, methylsuccinic and suberic acids may be due to fatty acid oxidation disorders, and/or carnitine deficiency.
10. Elevated oxalic acid. This may be due to genetic disease or due to intestinal yeast or bacteria overgrowth.

After the first phone counseling session with the OAT results, they were not interested. They said they got too scared and overwhelmed and did not believe they would be able to go through the changes. Even though a supportive counseling was offered to them for free, they were not interested.

C. Comparison of the initial level of organic compounds in urine of the 20 children

A few major compounds in urine that were measured by the OAT were selected for presentation in this section. These compounds were selected because they appeared in at least a few (more than 4 times) in the whole group of the 20 children.

1. Figure 4.21 shows the level of arabinose in the OAT of all the children.

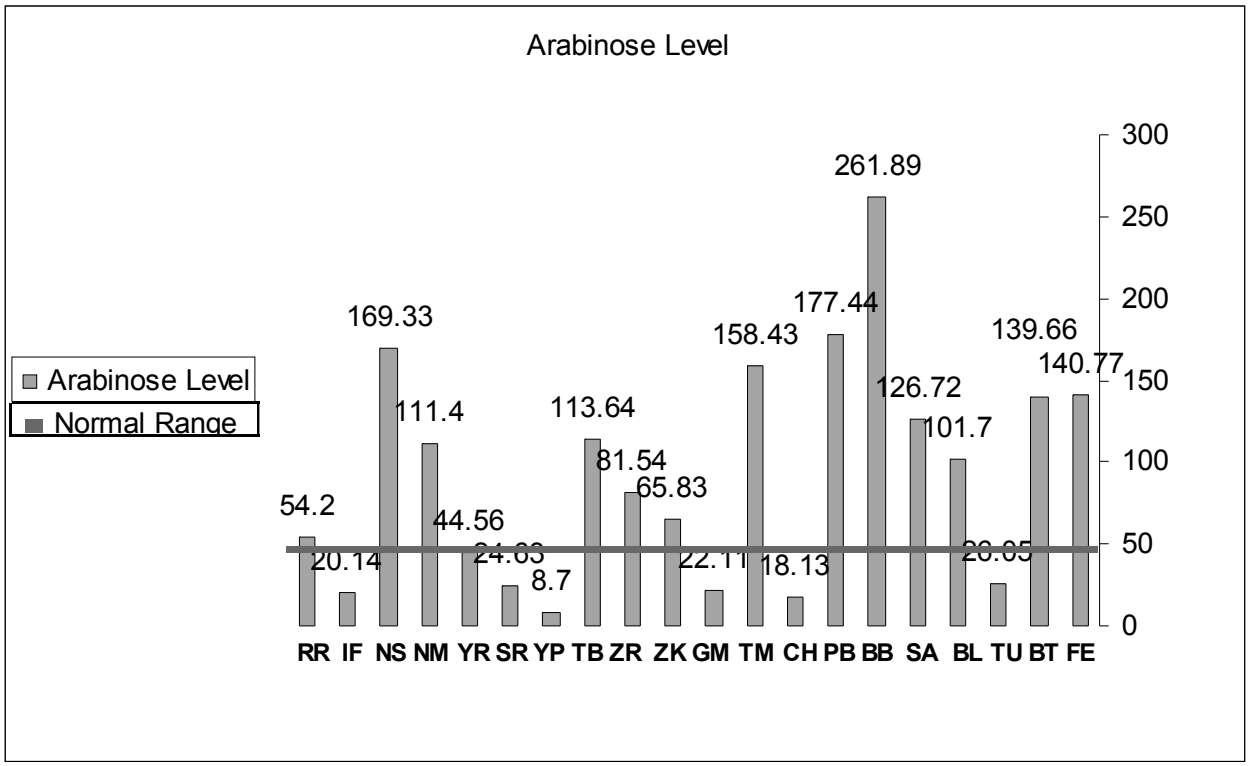

Figure 4.21: The level of arabinose in all the 20 OATs (normal range: 0-47):

As seen in Figure 4.21, 13 out of 20 children show high levels (above the normal range) of arabinose in their urine. This may indicate yeast/fungal overgrowth in their digestive system. Arabinose is associated with Candida overload. The children who have low levels of arabinose do not have yeast overgrowth in their GI tract, but they may have other biochemical abnormalities.

The majority of the children in this group have yeast/fungal overgrowth in their GI tract. This finding is consistent with the work of Dr. Shaw (1998, 2003), who established the Great Plains Laboratory, Inc. and Dr. Rimland (2005). They both stated that the majority of the children on the spectrum have yeast/fungal overgrowth in their GI tract (5 times that of normal controls).

2. Figure 4.22 shows the level of ascorbic acid in the OAT of the 20 children tested.

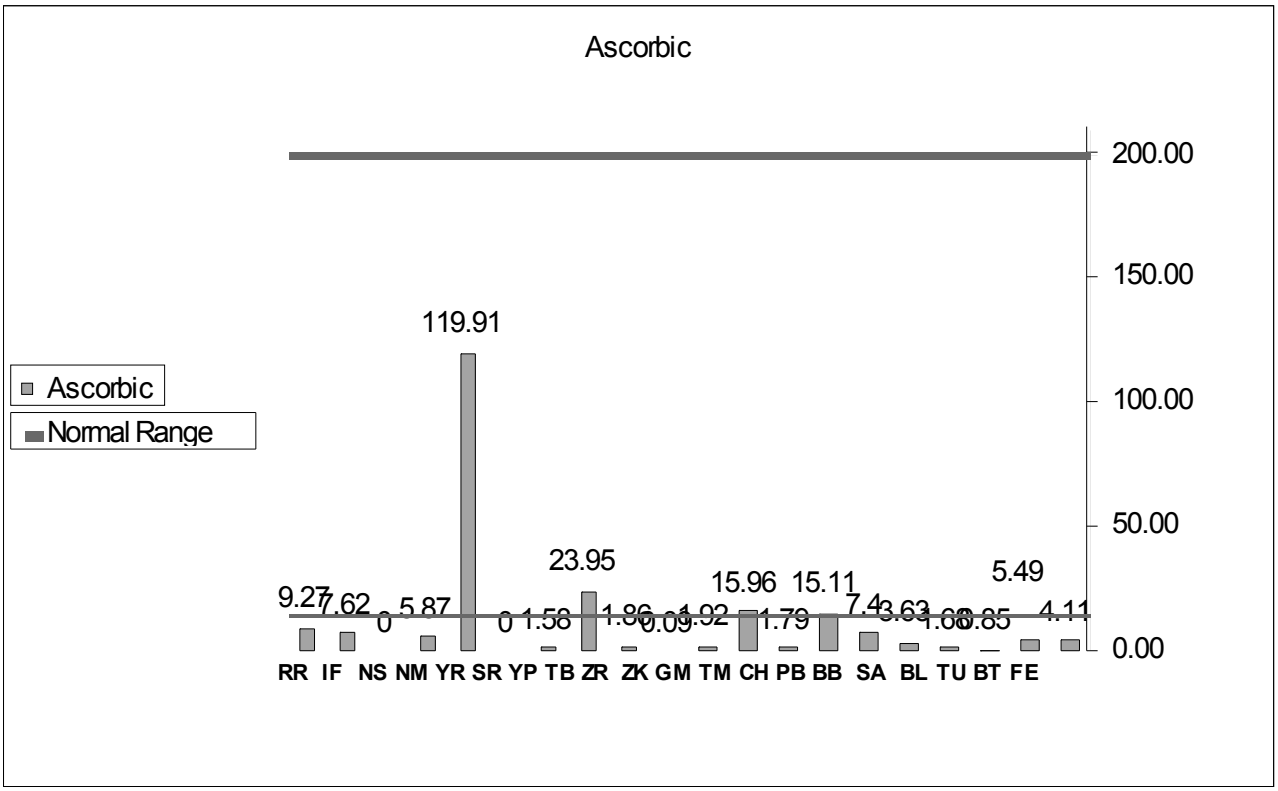

Figure 4.22: level of ascorbic acid in the 20 OAT's (normal range: 10-200)

As seen in Figure 4.22, 19 out of 20 children had a nutritional deficiency of vitamin C. T.B. has a normal level of ascorbic acid (23.95), but it is still quite low, and so are T.M. and P.B. Most of the children had very poor eating habits, and very poor nutrition. Most of them lived on pizza, pasta and cheese, without many fruits or vegetables. Vitamin C is an essential antioxidant and is also crucial in detoxification. The one OAT, which showed a higher level of vitamin C (for Y.R.) is still within the normal level. The children who have a below normal level of ascorbic acid, have a severe nutritional deficit and over utilization of antioxidants, and those who are within the normal level are still very low and not sufficient for the functions of detoxification

3. Figure 4.23 represents the level of hippuric acid in the 20 OAT's**.**

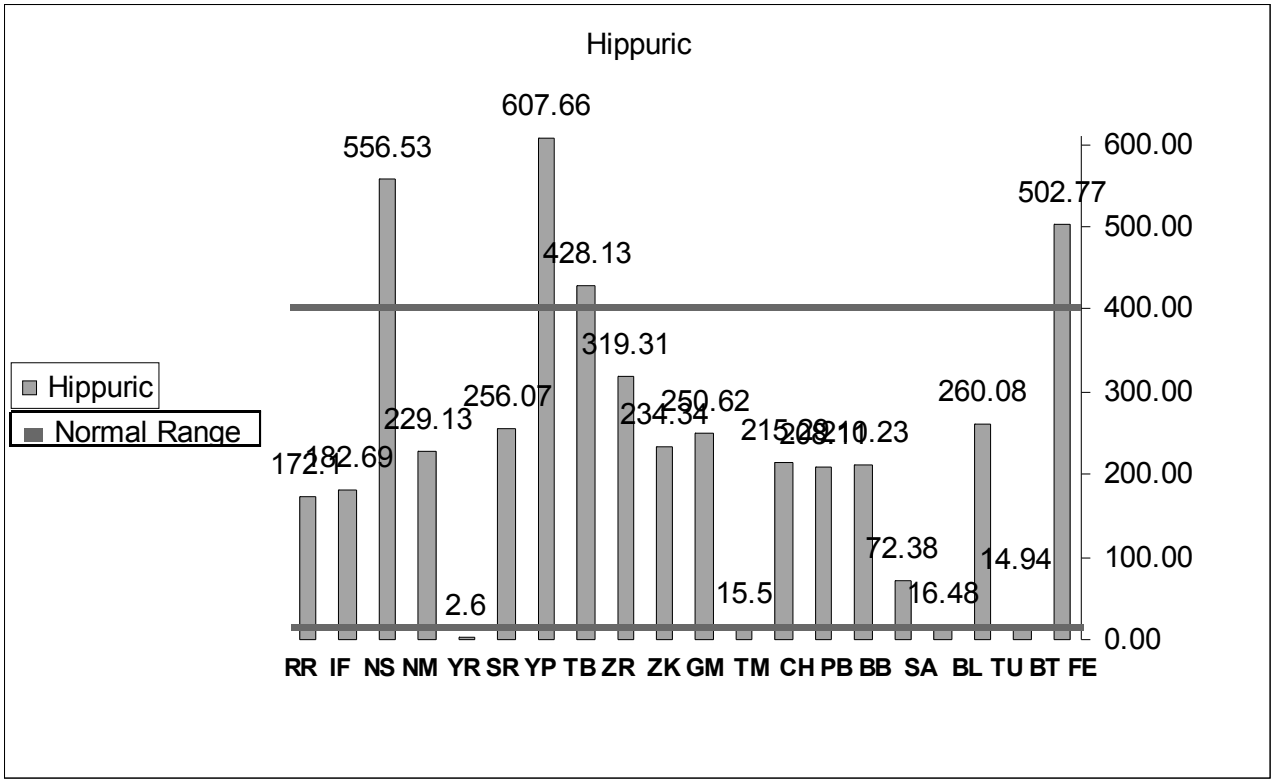

Figure 4.23: The different levels of hippuric acid in all the OATs (normal range: 10-400)

It can be seen that most of the children (12) were within the normal range of hippuric acid and 4 were above normal. Hippuric acid is a conjugate of glycine and benzoic acid formed in the liver. Benzoic acid is a food preservative and is also present in high amounts of cranberry juice. Benzoic acid is also derived from byproducts of GI bacteria and the chemical solvent toluene. High values are most commonly due to dysbiosis (abnormal microbial overgrowth). Exposure to toluene is mostly due to outgassing of new carpets or abuse of solvents such as glue-sniffing (Shaw, 1998, 2003).

4 children had above normal levels and 5 others have high levels within the normal range. These high levels may be due to detoxification problem, genetics or other reasons. When hippuric acid is very low or below the normal range, it is not a problem that needs to be treated. However, children who have no hippuric acid in their urine have other, different, biochemical abnormalities (Shaw, 1998).

4. Figure 4.24 shows the level of succinic acid in the urine of all the 20 children.

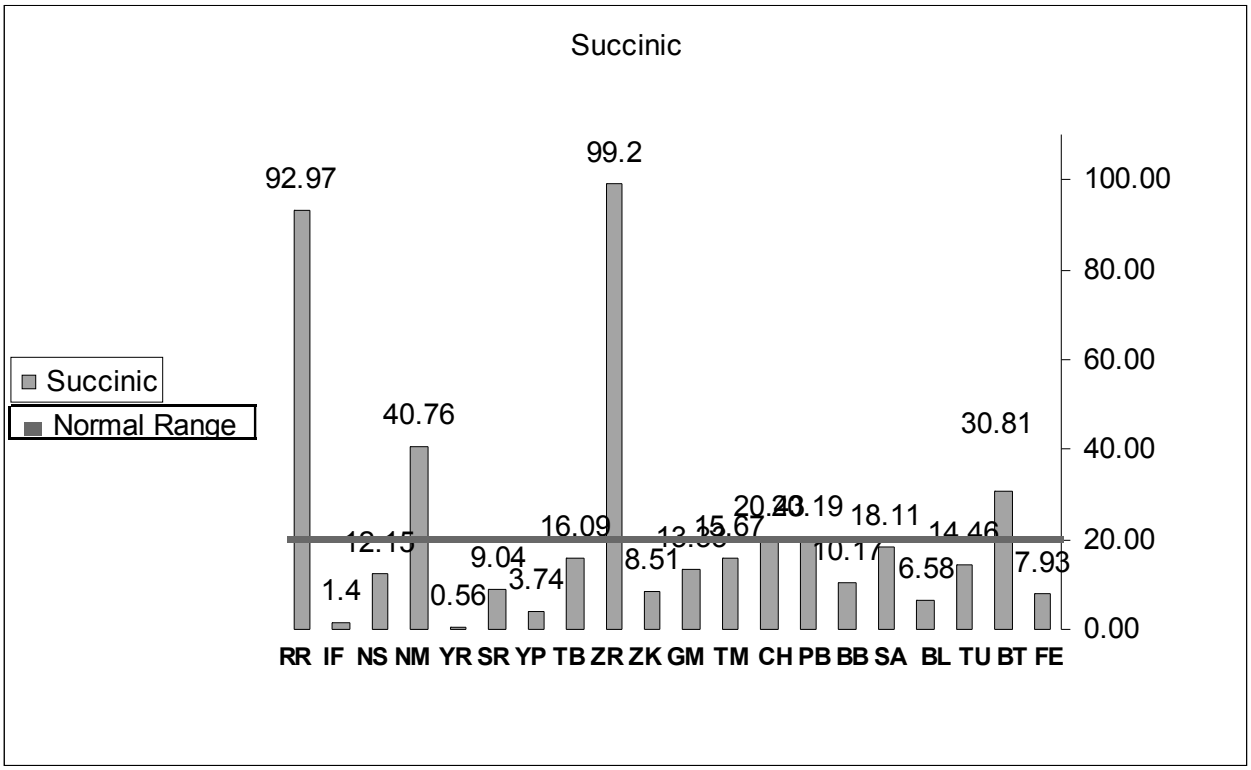

Figure 4.24: The level of succinic acid in all the OATs (normal range**:** 0-20)

As seen in the above figure, 16 out of 20 children were within normal range of succinic acid. Elevated succinic acid may indicate a relative deficiency of riboflavin and/or coenzyme Q10, which are needed to supply cofactors for succinic dehydrogenase in the Krebs cycle (Shaw, 1998).
4 children out of 20 needed supplemental addition of riboflavin and coenzyme Q10. The children, who have low or no succinic acid, do not need this supplementation but they still may have a dysfunctional Krebs cycle due to other reasons (Shaw, 1998).

5. Figure 4.25 and 5.26 represent the levels of VMA and VHA in all the 20 OATs. HVA is a dopamine metabolite and VMA is a metabolite of epinephrine and norepinephrine. Elevated levels of VMA and/or HVA indicate high stress level, which increases catecholamine output from the adrenal gland. Other causes of this increase are administration of L-DOPA, dopamine, phenylalanine or tyrosine. If values are more than double the upper limit of normal, the possibility of catecholamine-secreting tumors needs to be ruled out by further testing and consulting a neurologist.

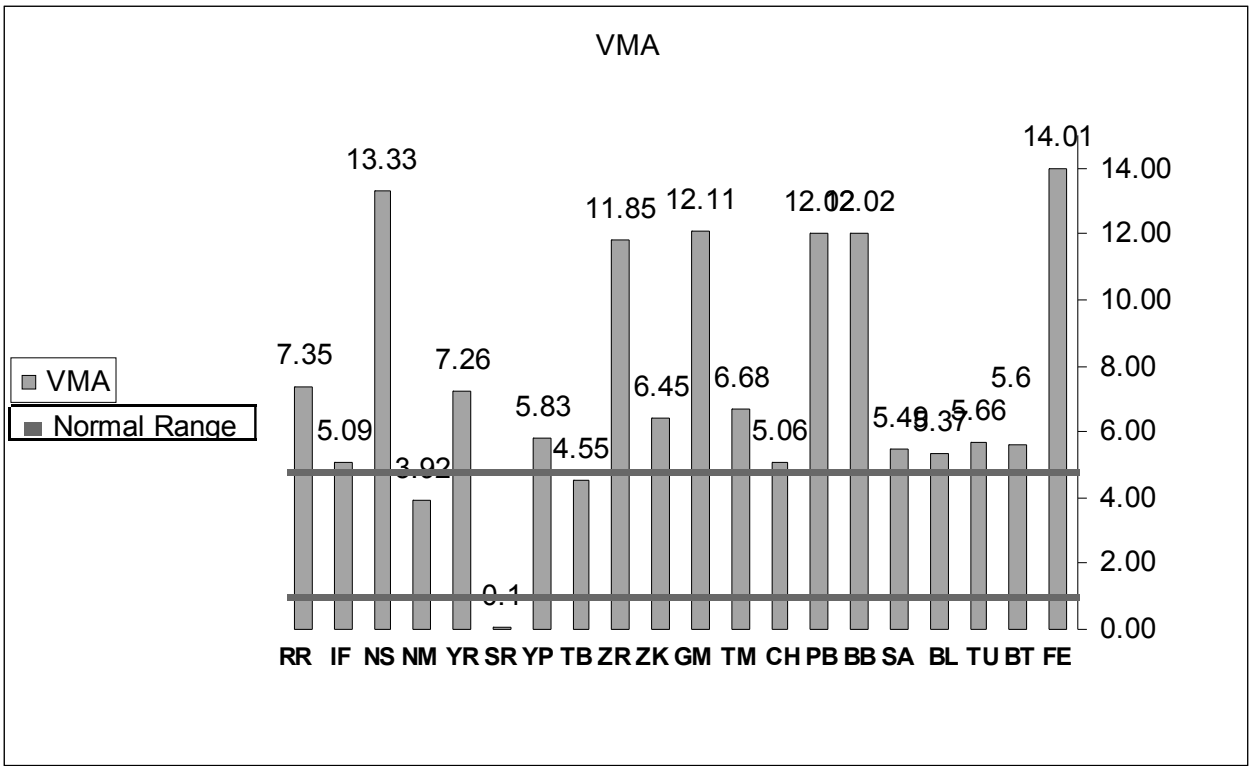

Figure 4.25: The levels of VMA in all the 20 OATs (normal range: 1-4.7)

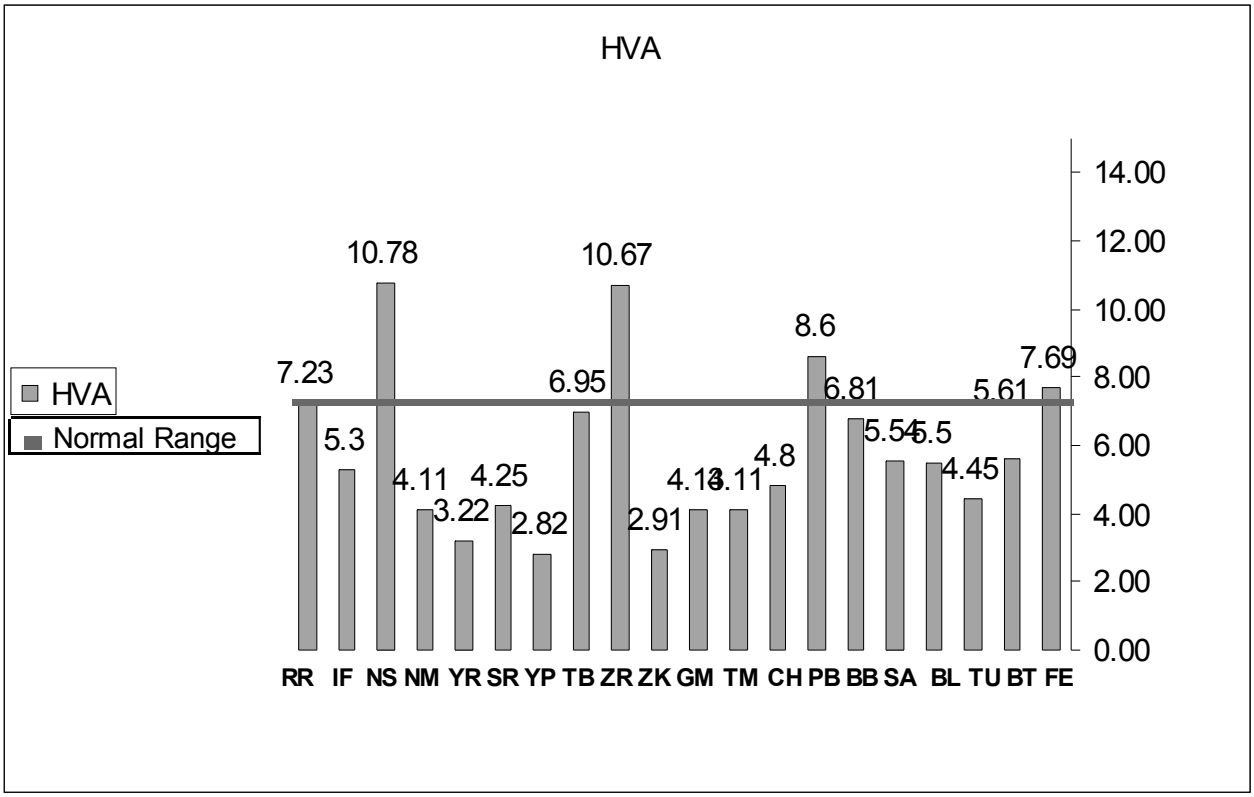

Figure 4.26: the level of HVA in all the 20 OATs (normal range: 0-7.5)

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From Figures 4.25 and 4.26 it can be seen that 17 out of 20 children had high values of VMA, and 11 had high-normal or above normal values of HVA. This indicates that the majority of the children suffered from an exhausted adrenal gland. Under usual circumstances additional supplementations would have been recommended for this condition, but the parents were already resistant to the cost and difficulty of administering “excessive supplementation” and some of the other supplements were already partially addressing this condition.

D. Comparison of the parents' rating on the developmental questionnaire

In this section a comparison of the parents' rating will be presented. The developmental questionnaire included aspects of behavior, attention and communication (see Appendix 3).

1. Figure 4.27 shows the rating of the parents for each child who did **not** complete the program. There were 11 children in this group.

Child's initials	G.M.	Z.K.	Z.R.	T.B.	Y.P.	S.R.	Y.R.	N.M.	N.S.	I.F.	R.R.
Age	4	12	4	8	13	5	3	3	5	4	1.10
Diagnosis	Autism	ADD	PDD	Epileptic	Epileptic	PDD	PDD	Autism	PDD	PDD	?
Motor problems	3	0	2	0	0	0	4	1	0	3	0
Eye contact	3	0	3	0	0	0	3	4	2	0	1
Response to speech	1	0	3	0	0	2	5	4	2	1	0
Language and comprehension	4	0	4	0	1	0	5	5	3	3	0
Social communication	4	0	4	1	0	4	5	4	4	3	0
Personal independence	3	0	3	1	0	0	5	4	4	3	0
Attention and concentration	3	4	3	1	0	4	5	4	4	4	1
restlessness	0	0	2	1	0	2	0	3	4	2	2
Sleep difficulties	1	0	0	1	0	3	0	0	0	3	0
hyperactivity	0	0	2	0	0	2	5	3	4	2	0
hypersensitivity	2	0	2	0	0	0	1	1	2	3	0
Self stimulation	4	0	2	0	0	0	5	1	5	2	0
tics	4	0	0	0	0	0	0	0	3	0	0
Memory and learning	3	3	2	0	3	3	5	3	2	2	0

Figure 4.27: The rating of the parents for each child, who **did not** follow through with the program (0=no problem, 5=severe, see the questionnaire in appendix 3):

As seen in Figure 4.27, **Z.K**., **Y.P**. and **T.B**. did not have symptoms of Autism or PDD. **Z.K**. had ADD and **Y.P**. and **T.B**. were epileptic. Although **T.B.** had a very high arabinose in her OAT, she does not have Autism.

Z.K. had a high level of VMA and arabinose, and yet, he did not have any communication problems, but he had a problem in attention and learning.

Y.P. also had a high level of VMA and hippuric acid, and he did not have Autism, but he had difficulties in memory and learning.

Y.R. had a normal level of vitamin C (the only one in the entire group), and low arabinose, and yet, he had severe problems of PDD, which may be related to his low pyroglutamic acid (a metabolite of glutathione), and deficiency of glutathione.

N.M. had a very high level of arabinose, increased succinic acid, citric and aconitic acids and low pyroglutamic acid, which indicated glutathione deficiency, and she also had nutritional deficiency of vitamin C and B12, riboflavin and coenzyme Q10. These factors contributed to her severe condition of PDD, but there were other children with severe PDD, who did not have all these factors in their OAT. However, when the Krebs cycle is impaired, there must be an influence on the function of the brain.

N.S. also had a severe PDD, his VMA/HVA were very high (due to stress), he had a high level of yeast/fungal overgrowth (a very high arabinose as well as 3-oxoglutaric and 5-hydroximethyl-2-furoic), and high hippuric acid, which indicated a toxic exposure (benzoic acid).

I.F. was also a boy with PDD, who had a **low** arabinose level and **low** VMA/HVA. His OAT showed nutritional deficiencies (C and B vitamins) and low pyroglutamic acid, which means glutathione deficiency.

R.R. was the youngest girl (22 months) in the group, who had many problematic aspects in her OAT, such as high arabinose and citramalic acids, high succinic and aconitic acids (glutathione deficiency), dietary deficiency of vitamin C, riboflavin and coenzyme Q10, and fatty acid oxidation disorders. And yet, her rating on the above questionnaire was low, as if she had no developmental problem at all. Perhaps she was too young for such an assessment.

As described above, there are too many factors involved in each child's condition as well as his/her genetic disposition. These factors are not the causes of Autism or PDD, but they are biological/biochemical aspects that may contribute to the physical/behavioral/cognitive symptoms. These aspects can be treated, so the nervous system will be able to function in a more efficient, healthy and stable way.

2. Figure 4.28 shows the ratings on the parents' questionnaires **before and after** the counseling and the implementation of the program. There were 9 children in this group.

Child's initials	F.E		B.T.		T.U.		B.L.		S.A.		B.B.		P.B.		C.H.		T.M.	
Before/After	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A
Age	5		3		4		6		3		7		5		4.5		3	
Diagnosis	PDD		Autism		PDD		Autism		PDD		Autism		Autism		PDD		PDD	
Motor problems	3	2	0	0	5	3	3	2	3	2	3	2	5	3	0	0	1	0
Eye contact	1	0	3	1	4	2	4	2	2	1	1	1	3	1	2	1	2	0
Response to speech	2	1	3	1	4	2	4	3	3	1	3	2	4	2	2	1	1	0
Language and Comprehension	3	2	3	2	4	2	4	2	4	2	4	3	4	2	3	1	0	0
Social communication	4	3	4	1	5	3	4	2	3	1	4	3	4	2	2	1	3	0
Personal independence	4	3	4	2	5	3	1	0	3	1	4	3	5	3	0	0	2	0
Attention and concentration	4	2	2	1	5	3	1	0	3	1	4	3	4	2	2	1	0	0
Restlessness	4	2	1	0	5	3	0	0	0	0	4	3	5	3	2	1	1	0
Sleep difficulties	2	0	4	2	3	1	3	2	0	0	4	3	1	0	0	0	1	0
Hyperactivity	4	2	1	0	5	3	0	0	0	0	4	3	0	0	1	0	0	0
Hypersensitivity	3	1	2	1	3	1	0	0	0	0	3	2	3	2	2	1	0	0
Self stimulation	1	0	2	0	4	2	0	0	1	0	4	3	0	0	0	0	0	0
Tics	0	0	0	0	4	2	0	0	0	0	3	2	0	0	0	0	0	0
Memory and Learning	5	2	0	0	3	2	3	1	0	0	2	1	4	2	0	0	0	0

Figure 4.28: The parents' ratings **before and after** the program for each child (0=no problem; 5=severe problem, see the questionnaire in Appendix 3):

From Figure 4.28 it is clear that most of the children who followed through with at least part of the program (diet change and/or supplements), made an improvement in certain aspects of their behavior and development. If we could have a second OAT for each child, it would have been interesting to see if there were physiological and biochemical changes as well. Since we did not have any funding for this project, the parents chose not to do a second OAT, and were satisfied with their children's progress.

3. The children's progress in the different parameters:

The following figures show the children's progress after implementing the program, in a few parameters of the developmental questionnaire, as rated by the parents:

1. Figure 4.29 shows the improvement in Motor problems.

2. Figure 4.30 shows the improvement in eye contact.
3. Figure 4.31 shows the improvement in social communication.
4. Figure 4.32 shows the improvement in attention and concentration.
5. Figure 4.33 shows the improvement in self-stimulation behavior (see appendix 3).

These figures are designed for the entire group of 9 children.

In addition, the improvement of each child will be examined individually regarding all the parameters of the developmental questionnaire, as rated by the parents before and after the program.

1. Change in motor problems

Figure 4.29: The change in motor problems as rated before and after the program by the parents for the whole group (0=no problem; 5=severe problem):

As seen in figure 4.29, 6 out of the 9 children had mild or severe motor difficulties. The 2 children who had no motor problems remained the same (B.T. and C.H.). The children who had motor difficulties made a progress and were rated as less severe (from 3 to 2). The major change occurred in T.U. and P.B. (from 5 to 3). T.M. went down from 1 to 0. He does not have any motor difficulty after the program according to his parents.

2. Change in eye contact

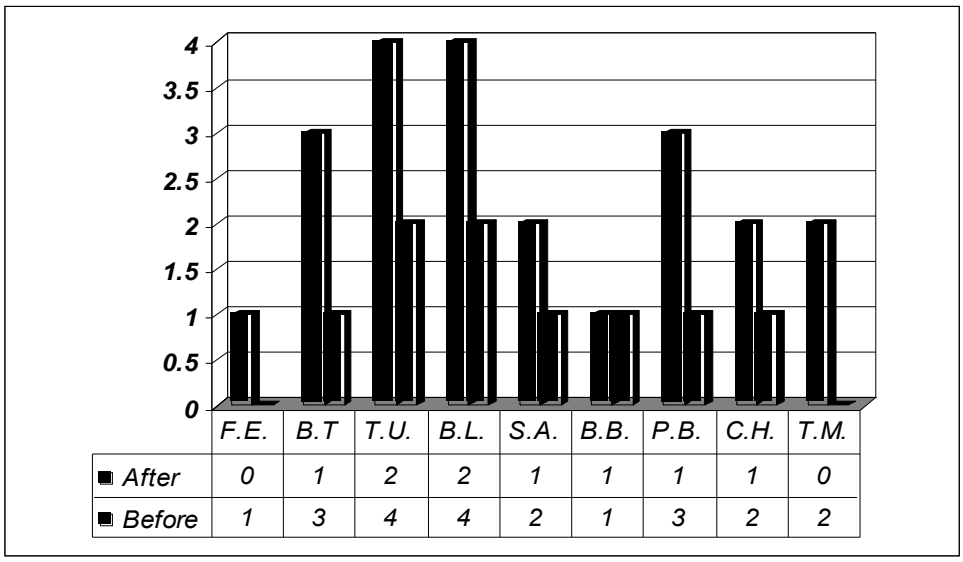


Figure 4.30: The change in eye contact as rated by the parents before and after the program for the whole group (0=no difficulty, 5= severe problem)

As seen in figure 4.30, many of the children had difficulty maintaining eye contact. 7 out of the 9 children had a mild or severe problem (3-4). F.E. was rated 1 before the program, and after the program had no problem at all in eye contact. B.B. had a slight problem and remained the same (1). The rest of the children show a remarkable change of 2 points: from 4 to 2 or from 3 to 1.

3. Change in social communication

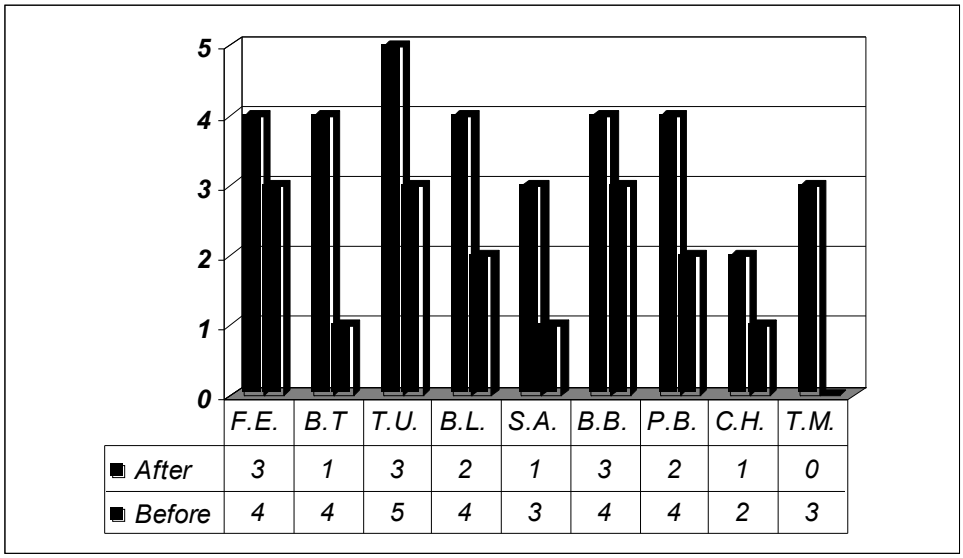


Figure 4.31: The change in social communication as rated by the parents before and after the program for the whole group (0=no difficulty, 5=severe problem).

As seen in figure 4.31, 7 out of 9 children were rated with mild to severe difficulty (3-5). They have all made a positive change after the program. T.M. was rated 3 before the program and 0 after the program (which still continues at the present time). He functions now as a normal child of his age, according to his parents. B.T. also made a remarkable change from 4 to 1. It is important to note that none of the children got worse.

4. Change in attention and concentration

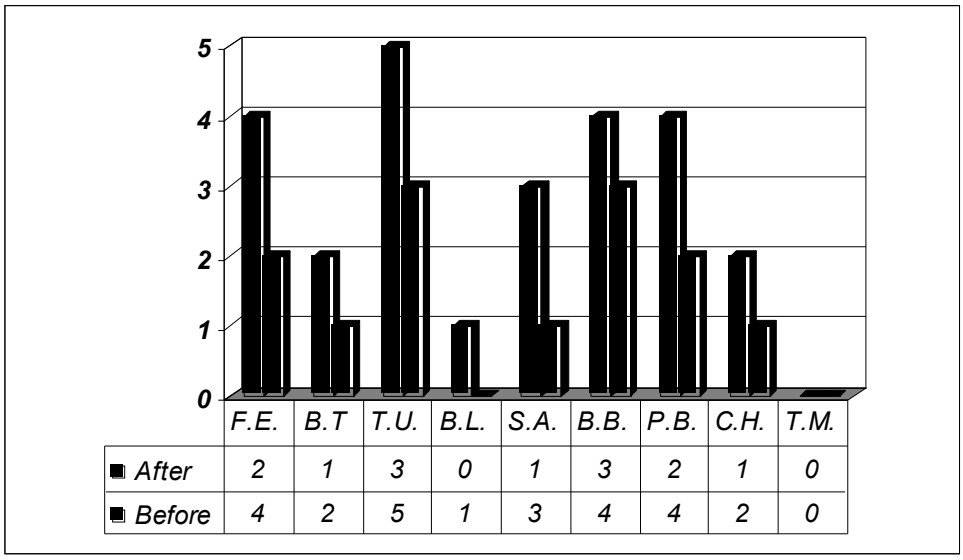


Figure 4.32: The change in Attention and Concentration as rated by the parents before and after the program for the whole group (0=no difficulty, 5=severe problem):

As seen in Figure 4.32, 5 of the 9 children had mild to severe difficulty in attention and concentration. T.M. had no problem in this area according to his parents. B.L. had a slight difficulty and after the program she had no problem in attention and concentration. All the children made relative progress in this area.

5. Change in self stimulation behavior

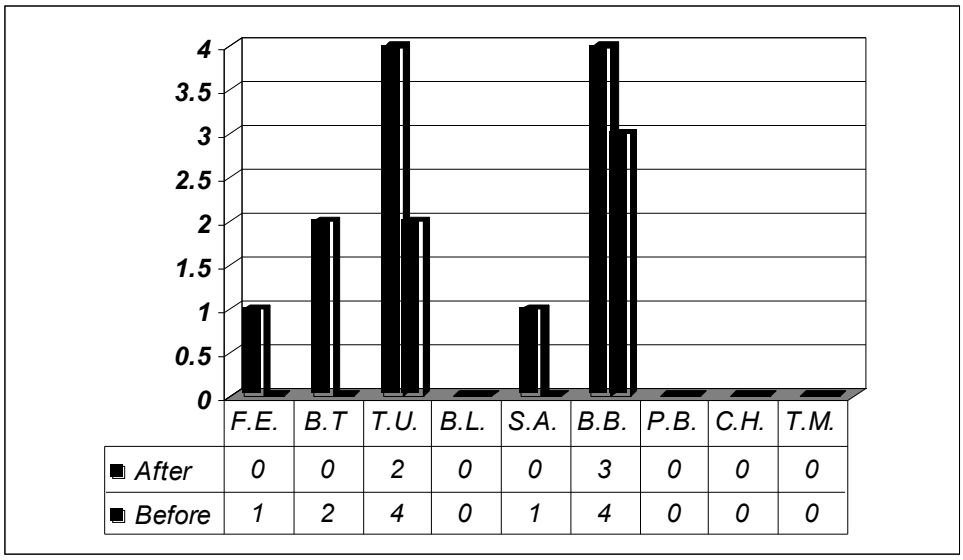


Figure 4.33: The change in self stimulation behavior as rated by the parents before and after the program for the whole group (0=no problem, 5=severe problem).

As seen in Figure 4.33, not all the children with PDD or Autism have self stimulation behaviors. B.L., P.B., C.H., and T.M. had no problem in this area. Those who had a self stimulation behavior have improved dramatically. F.E., B.T. and S.A. stopped completely, and T.U. and B.B decreased from 4 to 2 and from 4 to 3. None of the children got worse.

E. Comparison of various parameters measured by developmental questionnaire before and after the counseling

The following figures show the comparison of the 9 children who participated in the full or partial program, before and after, on the various parameters of the developmental questionnaire (see Appendix 3).

1. **F.E. - PDD**

Figure 4.34 represent the change in all the parameters of the questionnaire of F.E. before and after the program.

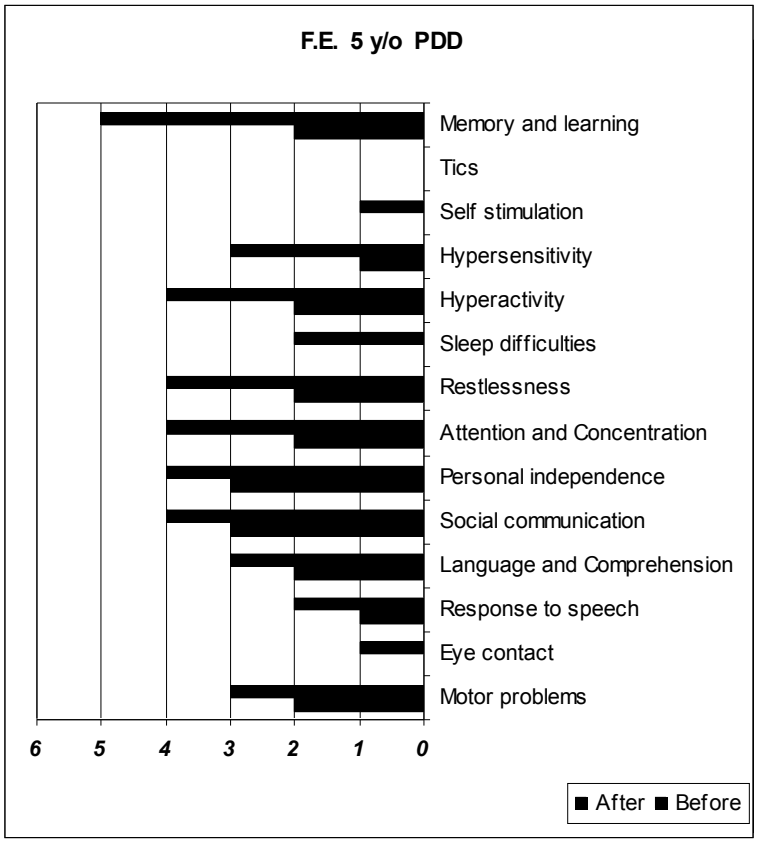


Figure 4.34: The change in all the parameters of the questionnaire of F.E. before and after the program.

As seen in Figure 4.34, F.E. had severe (4-5) difficulties in behavior, social communication, personal independence, attention and concentration, restless and hyperactivity, and memory and learning. All these parameters changed dramatically to 2-3. Before the program he had sleep disturbances, self stimulation and problems in

eye contact, and after the program he had no problem in these areas. He also improved in his motor skills from 3 to 2.

2. **B.T. -Autism**

Figure 4.35 describes the changes in all the parameters of the questionnaire of B.T. before and after the program.

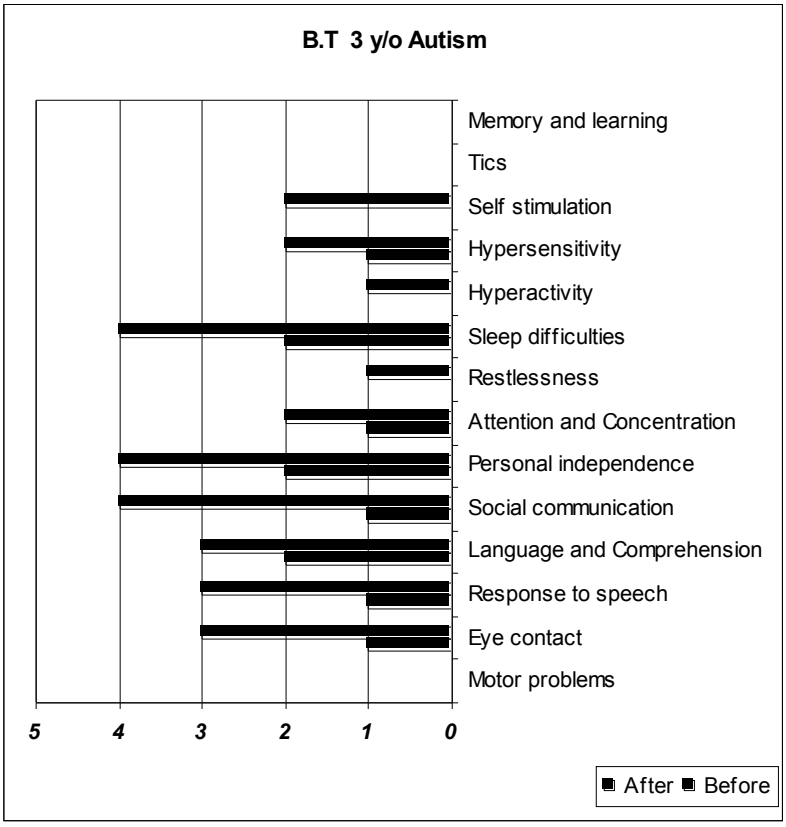


Figure 4.35: the changes in all the parameters of the questionnaire of B.T. before and after the program.

As seen in Figure 4.35, B.T. had severe difficulties (4) in social communication, personal independence and sleep. These improved to mild difficulties only (2). He also improved in eye contact (from 3 to 1), response to speech (3 to 1), language and comprehension (3 to 2), attention and concentration (2 to 1) and hypersensitivity (2 to 1). After the program, he had no problems in hyperactivity, self stimulation and restlessness.

3. **T.U. - PDD**

Figure 4.36 represents the changes in all the parameters of the questionnaire of T.U. before and after the program.

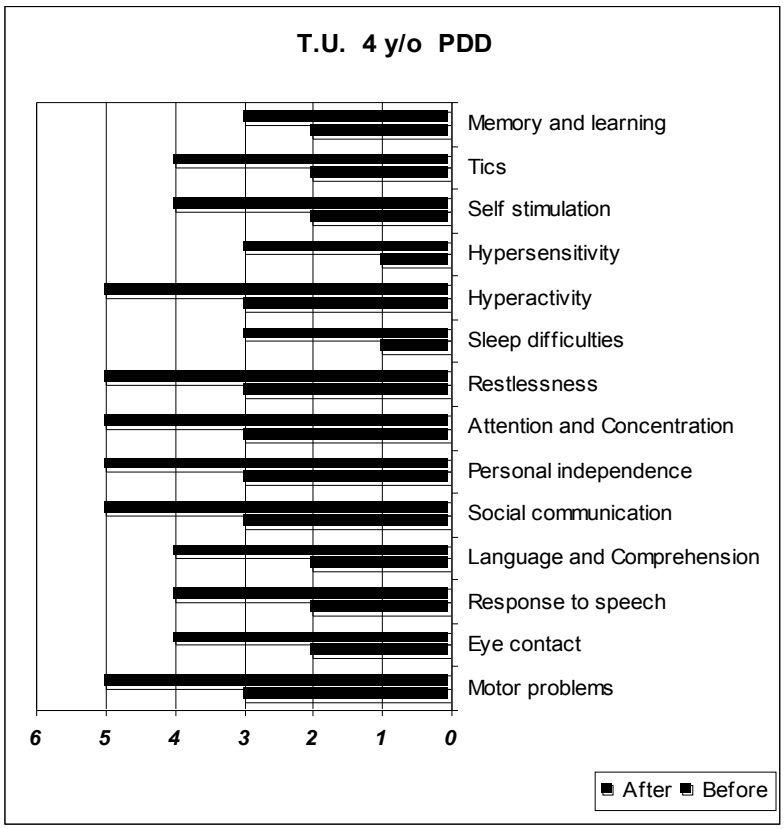
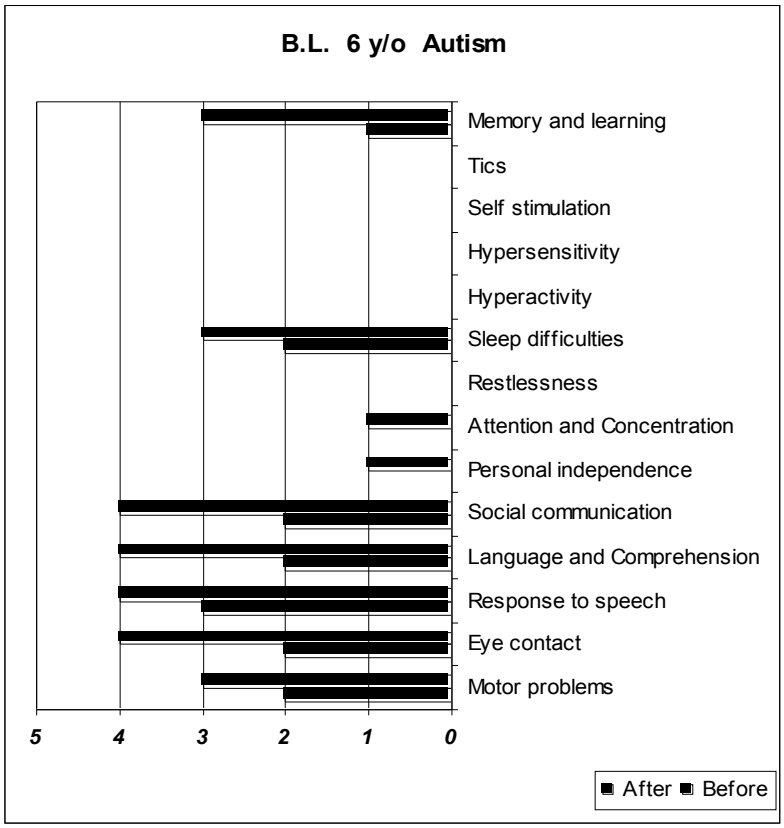


Figure 4.36: The change in all the parameters of the questionnaire of T.U. before and after the program

As seen in Figure 4.36, T.U. had severe problems (5) in the motor area, social communication, personal independence, attention and concentration, restlessness and hyperactivity before the program. He improved in all these areas after the program from 5 to 3. Self stimulation, tics, eye contact, social communication, language and comprehension and response to speech were also improved from 4 to 3 or 2. His hypersensitivity, sleep difficulties, memory and learning, have also improved from 3 to 2 or 1.

4. B.L. - Autism

Figure 4.37 represents the change in all the parameters of the questionnaire for B.L. before and after the program.



Figures 4.37: The change in all the parameters of the questionnaire for B.L. before and after the program:

As seen in Figure 4.37, B.L. had severe problems (4) in eye contact, response to speech, language and comprehension and social communication. She has improved in all these areas after the program from 4 to 3 or 2. She has also improved from 3 to 2 in sleep and motor difficulties, and from 3 to 1 in memory and learning. According to the parents' rating she had no difficulty in personal independence and attention after the program.

5. **S.A. - PDD**

Figure 4.38 represents the change in all the parameters of the questionnaire for S.A before and after the program.

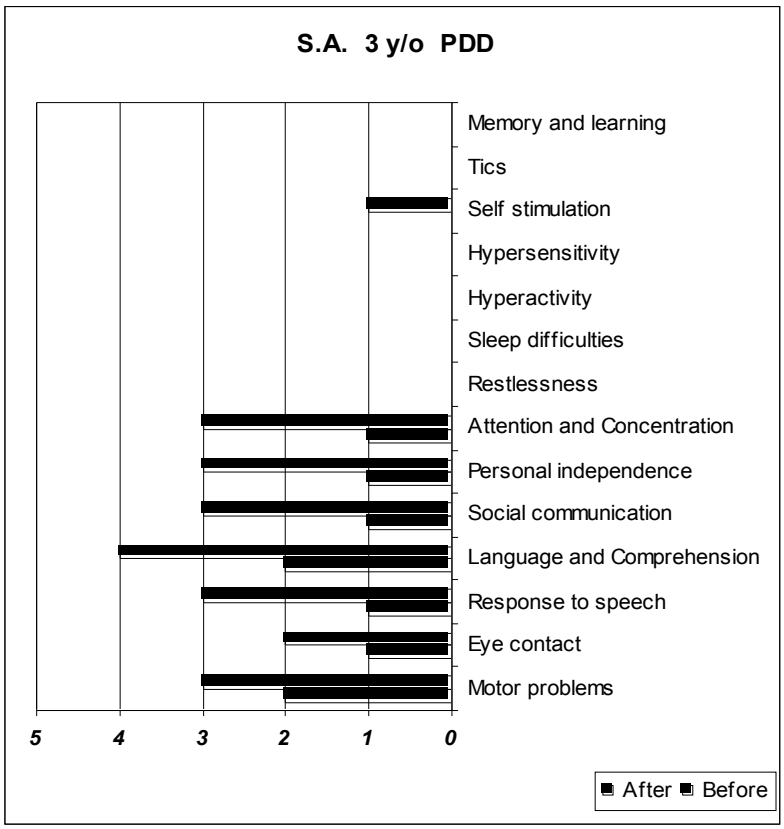


Figure 4.38: The change in all the parameters of the questionnaire for S.A. before and after the program

As seen in Figure 4.38, S.A. had severe difficulty in language and behavior, which have improved from 4 to 3 after the program. He has also improved in attention and concentration, personal independence, social communication and response to speech (from 3 to 1). Eye contact has improved from 2 to 1 and motor difficulties have gone down from 3 to 2. His self stimulation behavior has disappeared after the program. He had no tics, sleep disorder, hyperactivity or hypersensitivity before the program, and this has remained the same.

6. B.B. - Autism

Figure 4.39 describes the change in all the parameters of the questionnaire for B.B. before and after the program.

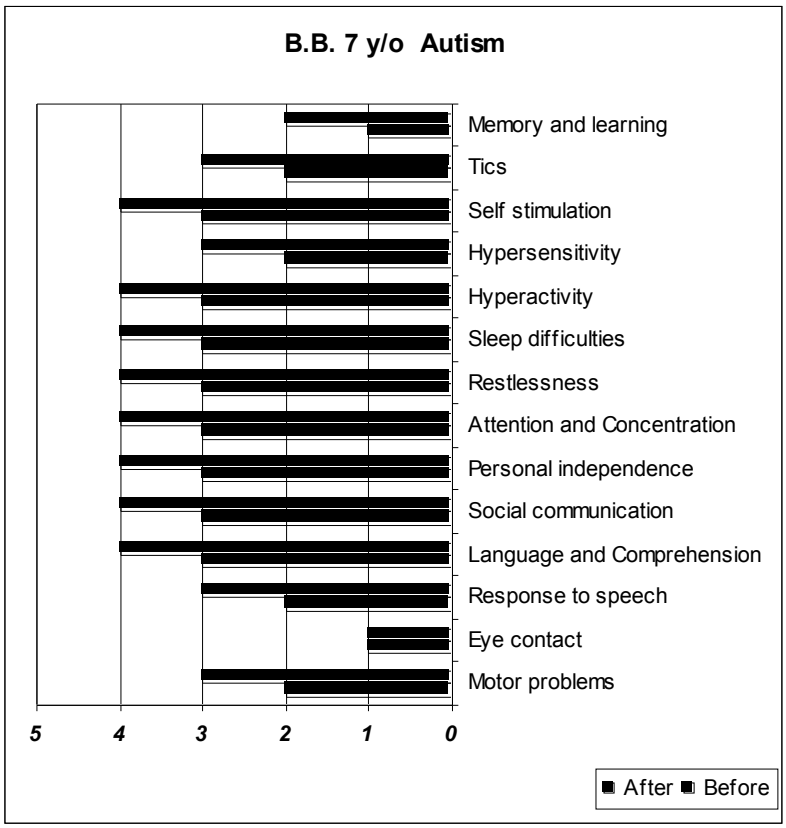


Figure 4.39: The change in all the parameters of the questionnaire for B.B. before and after the program:

As seen in Figure 4.39, B.B. had great difficulties in many areas such as language and comprehension, social communication, personal independence, attention, sleep disorders, restlessness, and self stimulation. These areas have improved slightly from 4 to 3. His response to speech, tics, hypersensitivity and motor difficulties have improved from 3 to 2. The slight difficulty in eye contact has not changed (1).

7. P.B. - Autism

Figure 4.40 represents the change in all the parameters of the questionnaires for P.B. before and after the program.

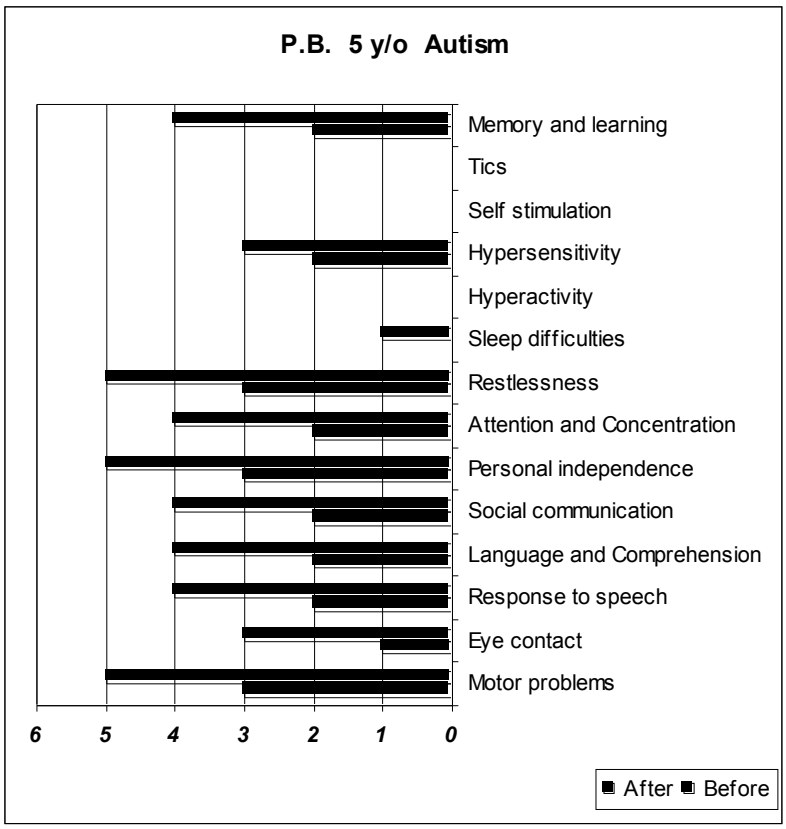


Figure 4.40: The change in all the parameters of the questionnaire for P.B. before and after the program**:**

As seen in Figure 4.40, P.B. had severe difficulties in the motor area, in personal independence and in his restlessness. These areas have improved to 3 after the program. His response to speech, language and comprehension, social communication, memory and learning, and attention, has improved from 4 to 2. After the program his slight sleep difficulty has disappeared. His difficulty in maintaining eye contact has improved from 3 to 1.

8. C.H. - PDD

Figure 4.41 describes the change in all the parameters of the questionnaire for C.H. before and after the program.

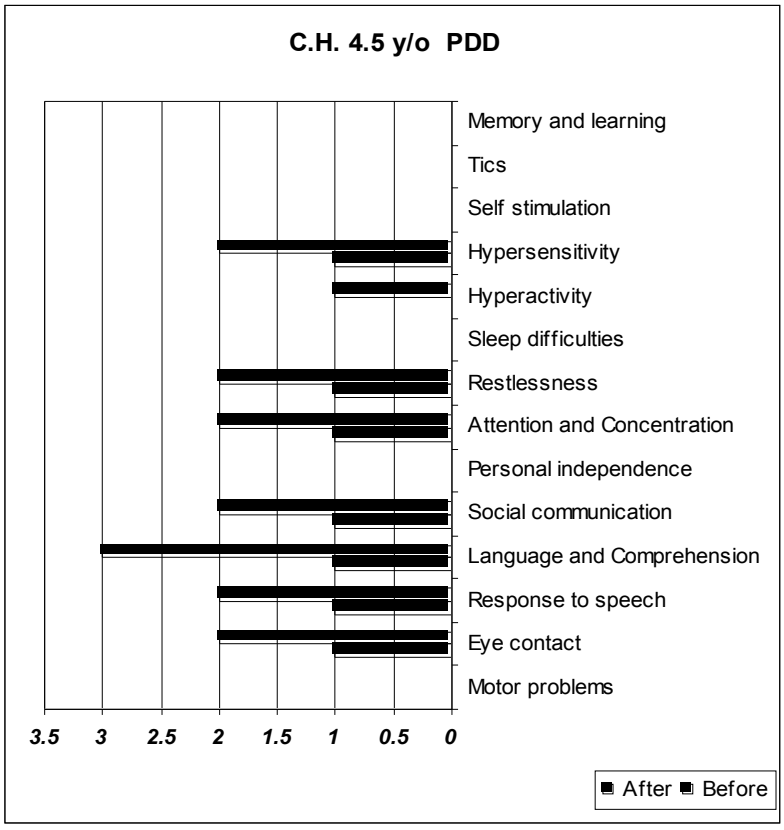


Figure 4.41: The change in all the parameters of the questionnaire for C.H. before and after the program.

As seen in Figure 4.41, C.H. had a mild difficulty in language and comprehension before the program, and it has improved from 3 to 1 after the program. The slight difficulties he had in hypersensitivity, restlessness, attention, social communication, response to speech and eye contact, have all changed from 2 to 1 after the program. His slight hyperactivity has disappeared after the program. He had no difficulties in sleep or in personal independence, no tics or self stimulation behavior, and this has remained the same.

9. T.M. - PDD

Figure 4.42 represents the change in all the parameters of the questionnaire for T.M. before and after the program.

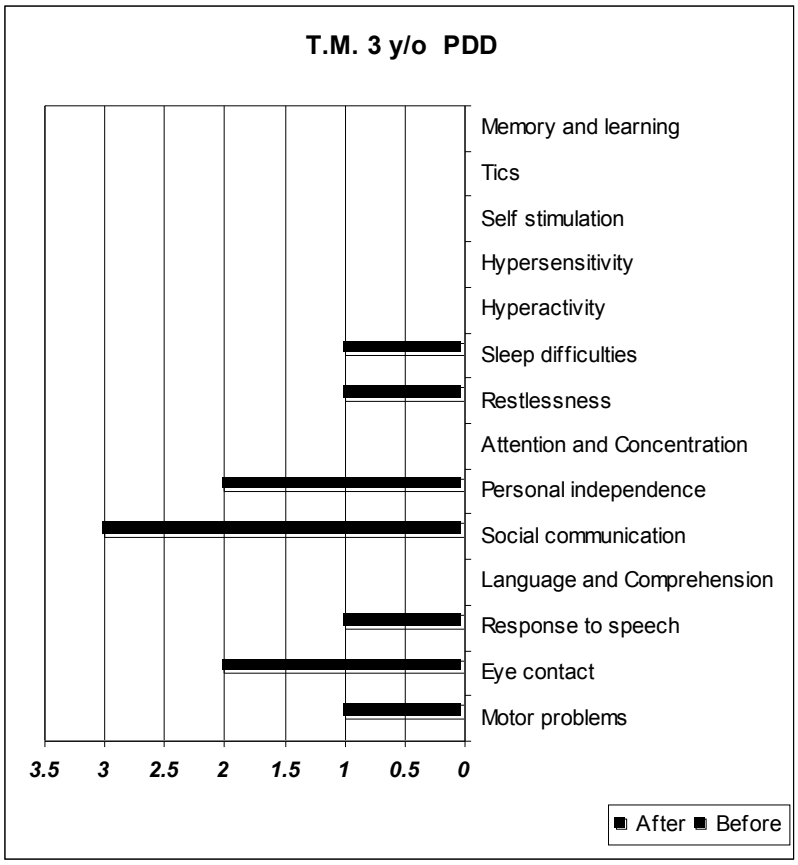


Figure 4.42: The change in all the parameters of the questionnaire for T.M. before and after the program.

As seen in Figure 4.42, T.M. had a mild difficulty in social communication (3), which has changed into 0 after the program. He also had slight problems in sleep, restlessness, personal independence, eye contact, response to speech and in the motor area. All these parameters have improved and were rated as 0 by his parents. As they said "he is a normal child to his age".

Summary of results

In summary, the results show improvement in many areas of function in all the nine children who followed through with the counseling program. The changes in diet, as well as the supplemental treatment, resulted in positive changes in behavior, eye contact, communication, speech and attention. Also, the parents reported remarked improvement in their children's digestion, health and energy level.

We can also learn from the Organic Acid Tests and questionnaires of the 11 children who did not follow through with the biological treatment for different reasons, and hope that in the future they, too, would benefit from a change in their diet and supplementation and improve their brain's function, behavior, communication and learning.

Chapter 5
Discussion

The aim of this study was to determine whether biological treatment could lead to improvement in the development and behavior of children on the neuro-behavioral spectrum or ASD - Autistic Spectrum Disorder. The 20 subjects who participated in this study were 16 children who were diagnosed with Autism and PDD, 2 with epilepsy, 1 with ADD and 1 has not yet been diagnosed. They all took the Organic Acid Test in Urine (OAT) developed by Dr. William Shaw (see Chapter 2, page 43). The OAT was used in order to determine which biochemical factors needed to be addressed, such as nutritional deficiencies, yeast, bacteria or fungus overgrowth, and what supplemental and diet help is needed to be given for each specific child. Nine children followed through with the recommendations. They all improved in behavior, communication and attention, according to their parents' questionnaire (see Chapter 4 – "before" and "after" - Figure 4.28, page 107). The other 11 children took the OAT and filled out the questionnaires, but there was no follow through with the program for different reasons. Their OAT and history were discussed in details on Chapter 4, but there was no "after" (see Figure 4.27, page 105)).

The Autistic Spectrum Disorder (ASD) has become an epidemic which has many suggested explanations, as discussed in the literature review (see pages 37-40). The anatomical abnormalities in the brain of children with ASD may be secondary to abnormal metabolic function caused by abnormal microbial metabolites and/or toxic peptides from wheat and milk, which in turn are due to an impaired immune system (Shaw, 2003). This study was not designed to find the causes, but to evaluate the effect of biological treatment on the children's behavior, communication and attention. There were 3 hypotheses to this study (see Chapter 3, page 61):

1) The first hypothesis was that bacterial dysbiosis and biochemical imbalances would be found in the OAT of children with neuro-behavioral disorders, such as elevated levels of arabinose, tartaric acid, citramalic acid and candida/yeast over-growth, as compared to normal lab results.

Thirteen out of the twenty children showed high levels of arabinose in their urine, indicating yeast/fungal overgrowth in their digestive system. This is the most significant finding in this study and is consistent with Dr. Shaw's work, who found that it is common in most of the children on the spectrum (Shaw, 1998, 2003). Many suffer from dysbiosis and "leaky gut" syndrome after receiving un-necessary antibiotics, which cause the overgrowth of the yeast in the GI tract.

2) The second hypothesis was that the physiological/biochemical factors would be more severe in children with greater or worse symptoms.

Most of the children in this study, who had more severe symptoms, also showed greater abnormalities in their OAT (such as yeast or bacterial metabolites from their GI tract, nutritional deficiencies, or problems in the function of the Krebs cycle). However, some children with severe abnormalities such as high arabinose or low vitamin C level did not have Autism or PDD. This indicates that many factors play a role in the etiology of ASD. A child can have a yeast overgrowth in his GI, but this alone does not mean that he will have Autistic symptoms. More elements are needed for developing these disorders, including a genetic disposition, low lithium levels in the mothers (Adams, et al. 2003), nutritional deficiencies, lack of glutathione (which is necessary for detoxification of toxic metals such as mercury), and/or impaired Krebs' cycle (Shaw, 1998, 2003).

3) The third hypothesis was that the children who follow through with the diet and treatment plan would improve on both the parents' and teacher's questionnaires.

According to the Autistic Research Institute, children who follow total 100% elimination of gluten and casein from their diet improve 50-70% (Rimland, 2003). Also, supplemental help leads to further improvement. Treating the yeast or bacterial overgrowth, vitamin and mineral supplementation and adding alpha lipoic acid and NAC (in order to treat glutathione deficiency) are just a few examples of implementing the biological treatment. In a large study of parents ratings on effectiveness of biological treatment (nutritional supplements) versus conventional medications, high effectiveness was reported by parents of ASD children for vitamin B-6, DMG, niacin, vitamin C, calcium and folic acid (Rimland, 2003).

In this study it was clear that the more steps were taken towards a wholesome healthy diet plus vitamin supplementation – the more signs of improvement were shown. All

the nine children who followed through with the treatment plan (even partially) have improved in behavior, eye contact, social-communication, speech and attention (see Chapter 4).

For the purpose of the discussion, it was chosen to separate the 2 children with epilepsy and the one with ADD. The youngest subject was 22 month-old girl who has not yet been diagnosed (her 2 brothers were on the spectrum). The rest of the group consisted of 6 children, who were diagnosed with Autism, and 10 children, who were diagnosed with PDD.
Since not all of them had teacher questionnaires, and in several cases it was not relevant, only the items of the parents' questionnaire will be discussed (when there was a teacher's response, it was stated within the results of the specific child – see chapter 4).

The following are important observations emerging from the findings of this study:

1. When we look at the OAT results, six of the ten children with PDD and five of the six children with Autism had high level of **yeast and/or bacteria** metabolites (arabinose and/or citramalic acid) in their urine. These children suffered from repeated ear infections and received oral antibiotics several times in their first years of development.
T.B., the epileptic girl, had also a high level of arabinose, but had no symptoms of Autism or PDD. On the other hand, G.M., the Autistic child, and S.R., I.F., C.H., and T.U., who had PDD, had no metabolites of yeast or bacteria in their urine, in spite of the oral antibiotics they had received, and yet, they suffered from severe symptoms of ASD. They were among those children who had other pathologies, such as problems with the Krebs cycle functions, vitamin deficiencies and overstressed adrenal glands (high VMA in their urine). Dr. Shaw (1998, 2003) stated that some or all of the abnormal anatomical structures that were found in the brains of affected children may be due to the toxic effects of the microbial metabolites or the abnormal peptides from wheat and milk just as the drug thalidomide caused abnormal limb development in children exposed to it in utero. These abnormalities are not specific for Autism. Elevated yeast and or bacterial metabolites were found in children with seizures,

Down's syndrome, Tourette's disorder, Fragile-x syndrome, Rett's syndrome and 80-90% of children with ADHD (Shaw, 1998, 2003).

2. All six Autistic and six of the ten PDD children had insufficient **Krebs cycle** function, which means reduced energy production in the cell level. This was found by tartaric, citramalic, succinic, aconitic, 2-oxo-glutaric and/or citric acids in their OAT. This was probably a major factor affecting the nervous system, causing difficulties in communication, attention, and behavior in these children. Tartaric acid, a highly toxic substance, inhibits the enzyme fumerase, which is important in the function of the Krebs' cycle, the biochemical process that produces most of the body's energy. The inhibition of fumerase also decreases the supply of malic acid for other functions of the cell. The proper function of the Krebs cycle depends on continuing supply of malic acid. If malic acid is not provided in sufficient quantities, the Krebs cycle is short-circuited, affecting the brain, resulting in reduced speech, eye contact and attention (Shaw, 1998).

3. Five of the six Autistics, and seven of the ten PDD children had extreme **vitamin deficiencies** according to their OAT. The nervous system requires vitamin B (especially B1, B6 and B12) as well as Co-Q10 and vitamin C. Only one PDD child (Y.R.) showed normal level of ascorbic acid in his OAT. T.B., the epileptic girl, had low-normal ascorbic acid in her OAT. Z.K., the ADD boy, also had vitamin deficiencies, but of course he did not have Autistic symptoms. His attention problem was probably affected by it, but there are other factors which play a role in developing ASD.

Vitamin C is an important antioxidant that can protect the body from free radical damage. It also helps increase glutathione, which protects the body from toxic metals like mercury. Vitamin C has been shown in a clinical trial to facilitate a reduction in symptom severity in children with Autism (Adams, et al. 2003). Most of the children in this study had severe malnutrition. This resulted in disorders in behavior, language, communication and attention. All the children who participated in the full program of this study have improved in most areas of function after receiving supplementation of essential vitamins. This was easier to follow than to change the entire diet.

Recent research has shown that children with ASD need unusually high levels of vitamin B6 because their enzymes for converting B6 are defective and insufficient (pyridoxal kinase). Vitamin B6 is important in dozens of roles, including making

neurotransmitters for proper brain function (Adams et al. 2003). A study of the effect of a multi-vitamin/mineral supplement on children with ASD was investigated in a 3-month, double-blind placebo-controlled study. 20 children with ASD (ages 3-8) completed the study. An evaluation of vitamin B6 levels prior to the supplementation found that Autistic children had substantially elevated levels of B6 compared to a control group of typical children. According to parental questionnaire, it was found that the supplementation group reported statistically significant improvement in sleep and GI problems, compared to the placebo group (Adams, et al. 2003). In this study many of the children had either a deficiency of vitamin B6 (as well as other B vitamins) or a high level of B6, due to the defective pyridoxal kinase, implying a functional need for more. This may explain why very high doses of vitamin B6 have been shown in numerous studies to benefit children with ASD (It should be given with magnesium) (Rimland, 2003).

Another study suggested a functional vitamin B12 deficiency in children with Autism who had elevated methylmalonic acid. Low B12 can cause many health problems, including fatigue (Shaw, 2003). Dr. Neubrander (in www.Drneubrander.com, 2005) has also shown the effect of methyl-B12 (methylcobalamin) treatment on many children of the Autism spectrum. In addition, in his website, Dr. Neubrander states that many recovered or nearly recovered Autistic children that no longer fall under the category of "Autistic" still require treatment, otherwise a regression occurs (as in diabetes). The treatment is usually done by injections given by the parents themselves. Since in this study there was no doctor to support the biological treatment, supplementation was given to the children by capsules or tablets. Most of the children received high doses of vitamin B complex including B6 and B12, vitamins C, E, A,D, magnesium and zinc, as well as changing into gluten and casein free diet (at least partially) and adding more fruit and vegetables. Some also received DHA or omega 3. All the parents reported improvement in GI function, sleep, behavior, attention and communication, a few months after starting the treatment. These findings are consisted with the above mentioned studies.

4. Five of the Autistics and seven of the PDD children had high levels of **VMA and/or HVA** in their OAT. The high amount of catecholamine discharge indicated a high stress level, and that their adrenal gland was exhausted and overstressed. Y.R., the epileptic boy, and Z.K. the boy with ADD, also had a high level of VMA.

5. Two of the six Autistics, and four of the ten PDD children had pyroglutamic acid in their OAT, indicating glutathione deficiency. Glutathione is essential for detoxification of toxic metals, such as mercury. As presented in the literature review, this deficiency is an important factor in the etiology of ASD. It is known that babies create less glutathione, and in the presence of testosterone detoxification is not possible. Females have estrogen that helps to keep the cells protected from the damage of mercury. This may explain why there are many more boys with developmental disorders than girls (about 5:1). Among the twenty children in our group only four were girls.

Children in this study who took supplementation of NAC and alpha lipoic acid (instead of glutathione, which is more expensive and expires quickly) improved in their language, communication, eye contact, attention and behavior.

In summary, it is difficult to state which supplementation has contributed more to these children, since they have done many things at the same time. It is also difficult to show whether the diet in itself or the supplementations themselves helped more. There are too many factors involved here at the same time, and each family implemented the program differently. While some took the vitamins first and then gradually changed the diet, others changed the diet first and added the supplements later, gradually. In some cases it took a few months until they received the vitamins and began giving them to the children. Parents have tried many ways of implementing the recommendations. Sometimes a child could not tolerate the taste or smell of a certain supplement and they had to try an alternative until they could find something he/she could tolerate. It was emphasized that the diet change is a recommendation for the long run and is the most important factor in the biological treatment, while the supplementation is for a shorter period of time. Since most of the children have not been eating fruit and vegetables at all, it took time and effort, as well as creativity, in order to facilitate the good new habits and a more healthy nutrition. Most of the parents reported immediate change in behavior and appetite as soon as they have given the child probiotics (acidophilus, lactobacillus, etc.) Some worked on the Candida protocol (a natural anti-yeast treatment, such as caprylic acid) and the child became more open to new wholesome foods.

The results of this study support the findings of Dr. Shaw, Dr. Rimland and others, who identified biological problems to be at the root of autism and other neuro-behavioral disorders (Shaw, 1998, 2003; Rimland, 2003, 2005). The conventional, orthodox treatments include medications, behavioral managements, and special schools that provide intense early intervention in language, motor and psychological areas. The problem with these usual interventions is that they focus on ameliorating **symptoms** rather than addressing the **underlying causes** of **Autism**. Medications may alleviate some behavioral and attention-related symptoms, but often with undesirable, cummulative toxic effects. Biological interventions were developed in order to treat the underlying biochemical factors and many children with ASD have already improved by this approach.

Chapter 6

Summary and Conclusions

As stated in the literature review (see Chapter 2), there has been a dramatic increase in Autism/PDD (or ASD, Autism Spectrum Disorder, as it is now being called). This epidemic has started perhaps in the 40's, when modern vaccinations and mercury-containing preservative (Thimerosal) have begun to be in use (Yazbak, 2004). Dr. William Shaw (1998, 2003) suggested that the epidemic was related to the increased use of antibiotics for ear infections in children, at about the same time (early 50's). Both reasons could be correct and perhaps synergistic, but the public health authorities would not approve or take responsibility for this epidemic (Rimland, 2003).

The approach of biological treatments has emerged in order to address the underlying biochemical causes for the symptoms of ASD. The aim of this study was to determine whether biological treatment would change the behavior, communication and attention in the children with ASD. 9 children out of 20, who took the OAT, followed through with the treatment program and improved in all areas of function, as rated by their parents' questionnaires. This research found that indeed biological treatment can affect behavior, eye contact, attention and communication in children on the Autistic spectrum.

Limitations of the study

Several limitations of this study should be considered:

1. This study had to rely on a small number of children. It would have been better if the subjects were randomly assigned to different biological treatments with broader representation of the sexes, ages and diagnosis. A concrete reward would have probably attracted more people, but there was no budget for this. The parents had to pay for the OAT themselves.

2. The OAT had given us an objective picture of only the initial biochemical state of these children. If we had a second OAT for each child after implementing the change in diet and in supplementation, we could have an objective biochemical measure of their improvement. Since this study had no funding, and the parents could not afford a second OAT, we had to rely on the parents' questionnaires only. However, relying on the parental questionnaires was quite subjective. What seemed

severe (5) to one parent could be moderate (4) or mild (3) to another, and visa versa. Sometimes the parents of the same child differ in how they had rated him on the different items, and it was sometimes difficult for them to agree. This has been shown in figures 4.27 and 4.28 (see Chapter 4, pages 105, 107). A child with Autism could be rated as 3 or 2 on eye contact, communication or attention, and a child with PDD could be rated as 4 or 5 on these items, even though PDD is a mild form of Autism. Z.K., the ADD boy, was rated as 4 on attention and concentration problem, although he had the least severe problem on the spectrum. But in most cases the problems were more severe (in general) in the Autistic children.

3. It is very hard to draw general conclusions from the results of this study. Different biochemical factors in different children with different ages with different diagnosis lead to different symptoms and different ratings by the parents. Therefore a **case study methodology** was chosen for this study. Each case was discussed separately and some comparisons were done as a group. In each case, the OAT was observed closely, as well as the specific recommendations needed and the implementation of the treatment by the parents. The parents' ratings were shown in "before and after" figures, for each child separately and as a group but no statistical analysis was done.

4. Only nine children followed through with the program. Twenty children took the OAT, but many of their parents could not find the energy or tenacity to change their habits or did not get the support from their spouses or from medical professionals. The counseling was done mostly by phone; perhaps personal meetings and conversations would have attracted more faith and trust, leading to better cooperation. Serious education cannot be done through the phone very effectively.

5. This study had no medical doctor in Israel that could supervise the ongoing process closely and support the families in changing their children's diet, watching the specific symptoms and taking the supplements in the correct doses. The proper medical steps were taken according to the OAT results, and were mostly manifested as dietary changes as well as natural supplementation. However, in order to achieve better compliance and very likely better results, closer clinical supervision would have been needed. For example, the symptoms anticipated during the die-off period after taking anti-fungal substances would need to be monitored and watched closely by a

licensed practitioner to increase the parents' confidence and compliance. In particular, the process of chelation (the removal of toxic metals from the body) could not be done without a local experienced practitioner supervising it.

In spite of all these limitations, the present study seems to indicate that even partial biological treatment can lead to improvement in children with ASD. In order to generalize the findings, **further research** that will involve larger samples, variety of subjects (different ages, sexes, diagnosis, etc.) and more reliable, objective measurements should be encouraged. Additional research is necessary in this newer area of biological therapy for children with ASD or neuro-behavioral disorders in general. Since the major concern of the researcher was understanding the factors which contribute to ASD and prevent them, it is necessary to design further research for treatment as well as prevention, such as educating parents and medical personnel about the use of antibiotics, stopping the use of Thimerosal-containing vaccines, or checking the mothers' prenatal lithium levels. As Dr. Shaw stated: "any child under 2 years old with frequent ear infections treated by antibiotics is at risk for Autism, seizures, and/or ADD and should be tested and treated if abnormal microbial overgrowth is present" (Shaw, 1998).
Additional studies should be conducted in order to determine more of the causes involved in these developmental disorders, so they can be prevented.

Since not many parents of children with ADD/ADHD have participated in this study (only one), and this child has not followed through with the diet or other biological treatment recommendations, it is assumed that parents of children with PDD/Autism spectrum (ASD) are either more aware of the treatment options or more concerned and willing to do everything possible (time-wise and money-wise) to help their child, who is having very serious problems (much more severe than ADD/ADHD).

All the children in this study have received regular vaccinations, some with severe reactions. Many of them are deficient in the substance glutathione, which is necessary for detoxification of toxic metals such as mercury. Many of the parents reported normal development and then a regression, after the vaccines and/or after taking antibiotics. These findings are consistent with Adams et al. (2003) who stated that

62% of the children with ASD were reported to have developed normally, with normal milestones, and then had a major regression at an average of 18 months.
As stated above and supported by the literature, most of the children who participated in this study had repeated ear infections and had received antibiotics several times early in their first and second years of life. Many of them were not nursed but were fed cow's milk, which contains antigens, hormones, and antibiotics. As a result, children with ASD have yeast and/or bacterial overgrowth in their gut. These poisonous microbes produce toxins in the digestive system, causing "leaky gut syndrome." Once the gut becomes permeable, these toxins enter the blood, as confirmed by urine OAT, and move on to the brain, affecting behavior, communication and language development.

Most of the children in the spectrum suffer from metabolic disorders, which require biological-medical intervention. They may have an insufficiency of certain enzymes in their liver, leading to a serious problem in detoxifying various toxins out of the body. They may have immune disorders, from a genetic origin or as a result of mercury poisoning. Many of these children suffer from food sensitivities and intolerance of the digestive system. They may have chronic constipation or diarrhea, and their immune system is so hypersensitive that it may cause many kinds of allergies and chronic infections (e.g. in the ears, bronchi, and lungs). Children on the spectrum may have a problem creating energy on a cellular level, and this of course affects the nervous system and the brain, so they may need supplemental help of nutrients such as glutathione or NAC and alpha lipoic acid.

From all the above, it is quite clear that the child and the parents need close medical guidance as well as emotional support in order to follow through with the proper diet and supplementation.

There are many successful cases that were documented by the "DAN!" program (Rimland, ARI). The main obstacle is the FDA, who still states (as of today) that there is no efficient treatment for Autism, and that Autism is a chronic disorder with no cure, in spite of scientific evidence which contradict this. For example, there are 22 studies in 6 states, which indicate that treating Autistic children with vitamin B6 and magnesium lead to remarkable improvement. 11 of these studies were double blind

with placebo controls, and the results were measured by objective physiological measurements, such as blood and urine indicators (Rimland, 2003).

Parents whose child is diagnosed to be in the Spectrum often feel desperate and helpless, especially at the first stages after the diagnosis is made, and experience anxiety, loss of the expectations for the child's future, and concern about how to help their child. The conventional treatment includes Occupational Therapy and Speech Therapy, at least 3 times a week, and most of the times they depend on health professionals (such as neurologists) who decide what should be done with the child. But there is a growing body of knowledge regarding biological-medical approaches, of which increasing number of parents are becoming aware. Thus, the aware parents can be more active in the treatment process and options for their child.

I am proposing a new model for multidisciplinary approach, where the parents are the leaders in the treatment process, and are active decision makers, together with the professionals they use. At the moment, unfortunately only the parents are taking responsibility for implementing biological treatments. The health professionals in Israel are just starting now to realize that something can make these children progress faster and perhaps even "lose their diagnosis." Most of them are still resistant to any treatment related to diet or nutritional supplements, and as in the USA, they cannot agree as to the suggested causes of ASD (as this will mean that they would be held responsible for ignoring proven environmental and nutritional factors, or even worse - poisoning these children, either by Thimerosal-containing vaccines or by unnecessary antibiotics).

The biological treatment (diet, detoxification, and supplements) is aimed toward internal ecological balance and stabilization of the digestive system, preventing chronic infections, and improving immune and nervous system functions through chelation (removal of mercury and other heavy metals from the body). **The recommended diet** is without any allergens or chemicals, gluten and casein, in addition to the antifungal treatment. Supplementation with enzymes, selenium, zinc, vitamins C, E, D and B complex, (B6, B12), magnesium, DHA-EPA (omega 3), and other products is recommended in order to help the body cope with chronic stress, chronic infections, and immune disorders and to increase detoxification capacities.

This approach is enhanced by keeping the child's environment as clean and as free of toxins and chemicals as possible.

This preliminary study, in spite of its limitations, shows that those children who have implemented the biological treatment recommendations even partially have improved in their behavior, communication and attention. Further research is needed in order to show not only the therapeutic effectiveness of this approach, but also its ability to prevent the development of ASD symptoms. The main reason for this study was the optimistic outlook as to the possibility of **prevention of developmental disorders in children**, by eliminating allergens and poisons, and by natural nutrition.

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www.autism.com/ari/ - Autism Research Institute

www.autism-society.org.800-3autism - Autism Society of America

www.autism-spectrum - online community of parents, caregivers and people living with autism

www.909shot.com - the National Vaccine Information Center

www.Feingold.org - information on diets without colors, flavors or preservatives

www.glutenfree.org - the gluten-free diet

www.GreatPlainsLaboratory.com - blood and urine test for yeast problems

www.healthsearch.com - Alternative treatment for ADD/ADHD

www.hyperactivekids.com/Resources.html

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www.dyslexic.org.uk

www.nativeremedies.com - herbal remedy for ADD

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www.autismndi.com

APPENDICES

Appendix 1:

The Organic Acid Test in urine (OAT) – one example:

The Great Plains Laboratory, Inc.

Patient ID		Physician Name	
Patient Name	BJ	Date of Collection	6/26/2004
Patient Age	3	Time of Collection	8:00 AM
Sex	Male	Report Date	07/07/04

Organic Acid Profile

Compound	Reference Range mmol/mol creatinine	Patient Value		Reference Interval Low / Normal / High
Neurotransmitters				
HVA	0.0 - 10.0	5.91		
VMA	1.0 - 6.6	5.60		
5-hydroxyindoleacetic	0.0 - 20.0	0.87		
Pyrimidines				
uracil	0.0 - 22.0	3.98		
thymine	0.0 - 2.0	0.49		
Fatty Acid Metabolites				
3-hydroxybutyric	0.0 - 10.0	2.11		
acetoacetic	0.0 - 10.0	0.30		
ethylmalonic	0.0 - 10.0	4.73		
methylsuccinic	0.0 - 5.0	1.26		
adipic	0.0 - 12.0	3.31		
suberic	0.0 - 2.0	5.98	H	
sebacic	0.0 - 2.0	1.10		
Toxic Indicators				
pyroglutamic	20.0 - 115.0	32.66		
orotic	0.0 - 3.5	3.29		
hydroxyhippuric	0.0 - 20.0	0.64		
Vitamin Indicators				
methylmalonic	0.0 - 5.0	2.63		
ascorbic	10.0 - 200.0	5.49	L	
kynurenic	0.0 - 2.0	1.01		
methylcitric	0.0 - 12.0	0.89		
pyridoxic	2.0 - 26.0	11.11		
pantothenic	1.0 - 4.0	9.26	H	
Miscellaneous				
glutaric	0.0 - 2.0	1.58		
N-acetyl aspartic	0.0 - 100.0	13.04		
3-hydroxy-3-methylglutaric	0.0 - 36.0	9.35		
glycolic	0.0 - 100.0	3.82		
oxalic	0.0 - 100.0	110.45	H	
malonic	0.0 - 10.0	3.56		
methylglutaric	0.0 - 10.0	0.61		
hippuric	10.0 - 400.0	14.94		
4-hydroxybutyric	0.0 - 5.0	0.34		
phenylcarboxylic	0.0 - 15.0	1.33		
indole-like compound	0.0 - 60.0	4.38		

The Great Plains Laboratory, Inc.

SM
William Shaw, Ph.D., Director 11813 W. 77 Street, Lenexa KS 66214 Tel: 913-341-8949 Fax: 913-341-6207

Patient ID
Patient Name BT
Patient Age 3
Sex Male

Physician Name
Date of Collection 6/26/2004
Time of Collection 8:00 AM
Report Date 07/07/04

Organic Acid Profile

Compound	Reference Range mmol/mol creatinine	Patient Value		Reference Interval Low / Normal / High
Yeast/Fungal				
citramalic	0.0 - 2.0	1.01		
5-hydroxymethyl-2-furoic	0.0 - 80.0	17.64		
3-oxoglutaric	0.0 - 0.5	0.19		
furan-2,5-dicarboxylic	0.0 - 50.0	14.00		
furancarbonylglycine	0.0 - 60.0	3.28		
tartaric	0.0 - 16.0	84.78	H	
arabinose	0.0 - 47.0	139.66	H	
carboxycitric	0.0 - 46.0	3.50		
Bacterial				
2-hydroxyphenylacetic	0.0 - 10.0	0.00		
4-hydroxyphenylacetic	0.0 - 50.0	148.73	H	
HPHPA formerly DHPPA-A	0.0 - 150.0	57.92		
VMA analog	0.0 - 31.0	0.99		
Glycolysis				
lactic	0.0 - 100.0	27.99		
pyruvic	0.0 - 50.0	5.45		
2-hydroxybutyric	0.0 - 2.0	0.21		
glyceric	0.0 - 10.0	0.64		
Krebs Cycle				
succinic	0.0 - 20.0	30.81	H	
fumaric	0.0 - 10.0	0.27		
2-oxo-glutaric	15.0 - 200.0	39.11		
aconitic	0.0 - 25.0	10.17		
citric	180.0 - 560.0	887.72	H	
Amino Acid Metabolites				
2-hydroxyisovaleric	0.0 - 2.0	0.85		
2-oxoisovaleric	0.0 - 2.0	0.00		
3-methyl-2-oxovaleric	0.0 - 2.0	1.35		
hydroxyisocaproic	0.0 - 2.0	0.12		
2-oxoisocaproic	0.0 - 2.0	0.08		
2-oxo-4-methiolbutyric	0.0 - 2.0	0.00		
mandelic	0.0 - 5.0	0.31		
phenyllactic	0.0 - 2.0	0.01		
phenylpyruvic	0.0 - 5.0	0.94		
homogentisic	0.0 - 2.0	1.43		
4-hydroxyphenyllactic	0.0 - 50.0	0.69		
3-indoleacetic	0.0 - 10.0	4.43		

$170 Bill Shaw

Data File Name 60795.D
Date Acquired 1 Jul 2004
Operator ssw

Appendix 2:

Nutrition questionnaire (Adapted from Gerber, 1993)

Name_____ age _____date_____

1. Did someone ever told you your child has a food allergy? Yes/no ; an allergy to medications? Yes/no _____

2. Is there an allergy or food sensitivity in the family? Yes/no

3. Are any of the foods he/she eats or strong odors makes your child feel bad? Yes/no specify_____

4. Circle the symptoms or illnesses, which are true about your child (in the past and/or the present): 0=no problem; 1=light problem; 2=mild problem; 3=slightly severe; 4=severe; 5=very severe.

Hay fever_____ digestive problems_____ sensitive sinuses_____ asthma_____ chronic infections _____ moodiness_____ skin rashes_____ congestion_____ depression_____ itchy_____ fluid retention_____ anxiety_____ colic_____ arthritis_____ insomnia_____ diarrhea_____ headaches_____ chronic fatigue _____bags or dark circles under the eyes_____ other_____

5. Describe cravings to special foods, and is there a definite preference of certain foods _____

6. Are there other un-explained chronic symptoms? (0-5)

_____

7. How many times in 3 days the child eats foods which contain the following substances (specify how many times a day or a week for each food):

wheat _____ red meat_____ yeast_____ dairy_____ tomato_____ coffee _____corn _____gluten _____chicken _____nuts_____ citrus _____olives _____beer_____ chocolate_____ seafood or fish_____ beans (which kind)_____ soy _____other_____

More information _____

_____

_____

_____

Appendix 3:

Developmental Questionnaire

Dear parents, please try to be specific in details, thank you.

Name of the child:_____ date of birth:_____ date: _____ names of parents: _____

Address: _____E-mail:_____ Phone no:._____fax:_____

Family history of developmental problems_____

Treatment before pregnancy _____symptoms or feelings during pregnancy _____ (nausea, bleeding, illness, etc.). Place of birth_____-__ birth was: 1.natural (easy/difficult), 2. tongs , 3. vacuum , 4. cesarean operation. Was born in what month of the pregnancy _____ with "APGAR"___ , weight in birth _____ , position in birth: head/ shoulders/ buttocks, umbilical cord around neck. Was in incubator: yes/no, for how long_____ After birth: immediate crying/ spontaneous breathing/ problems with breathing/ restlessness/ other_____ Breast fed: yes/no for how long_____ difficulties in breast feeding: yes/no what kind_____ Transfer to bottle : age_____ what kind: cows' milk/ soy milk/ other_____ Weaning off bottle: difficult/easy at what age_____ feeding problems and/or food sensitivities _____ Childhood illnesses_____ hospitalizations_____ Treatments_____ medications_____ Antibiotics: _____how many times and for how long_____ immunizations_____ Special phenomenon after immunization_____

Motor development: at what age (please write if there was something special):

Head raising_____ smiling_____ created eye contact_____ Crawled on stomach_____ sat by self____ crawled on all fours___ stood up____ walked_____ began speaking _____speech problems: yes/no what kind_____ stuttering: yes/no.

Remarks

_____

Potty training (at what age)_____ dry during the day____ dry during the night_____ today: wets during the: day/night

Remarks_____

____

Different habits (to be circled and specify age and for how long it lasted): pacifier_____ sucking finger_____ biting nails_____ Pulling on ear_____ pulling hair_____ biting lips____ eye blinking_____ head pounding_____ patting a doll or a cloth_____ attachment to a specific object_____ coughing_____ tics in face_____ tics in limbs_____ temper tantrums_____ rocking the body_____

Were there other special symptoms: shortness of breath/ loss of conscience/ convulsions/other_____

_____

Difficulties putting to bed: yes/no at what age_____ ;sleeping phenomenon (specify if in the past or present): falling asleep easily_____ ;wakes up many times_____ ;difficulty getting up in the morning_____; sleeps too little_____; talks while sleeping_____ screams while sleeping_____; teeth grinding _____; head banging_____; waking out of a dream (falls asleep immediately/having difficulty falling asleep again_____; walks during sleep_____; opens eyes without waking up_____; nightmares_____; sleeps with lights on_____; sleeps with an object_____; signs of fear when waking up_____.

Sensitivities (specify if in the past or present): touch and different textures_____; hypersensitive to touch_____; hypersensitive to sounds/noises_____; Hypersensitive to smells_____; hypersensitive to motion/needs motion (rocking, pinning)_____; sensitive to environmental substances (smoke, cleaning detergents, etc.)_____; other_____; special digestive problems

_____

reaction to stress _____.

Please rate from 0-5 (for the present only – but specify if there was a loss of eye contact, for example, and then was gained back and lost again): 0=no problem; 1=light problem; 2=mild; 3=a little more severe; 4=high severity; 5=very high severity

Motor difficulties_____

remarks_____

Eye contact _____

remarks_____

Response to speech _____

remarks_____

Language & comprehension _____

remarks_____

Social communication _____

remarks_____

Personal independence _____

remarks_____

Attention & concentration_____

remarks_____

Restlessness_____

remarks_____

Sleep problems_____

remarks_____

Hypersensitivity_____

remarks_____

Overactivity_____

remarks _____

Self stimulation_____

remarks_____

Tics _____

remarks_____

Memory & learning _____

remarks_____

Other behavioral phenomenon or difficulties you observe at home :

_____

_____

Thank you for your cooperation

Appendix 4:

Conners' questionnaire – DSM-IV (for the teacher)

Name_____ grade ____age____ name of teacher_____ school_____ date_____ Please put an x in each column according to severity of the problem: very much(3), a lot(2), a little(1), not at all(0)

			Very much	**A lot**	**A little**	**Not at all**
Inattention	1	failing to pay attention to details or making careless mistakes in schoolwork or other activities				
	2	difficulty sustaining attention in tasks or play activities				
	3	not seeming to listen when spoken to directly				
	4	not following through on instructions and failing to finish schoolwork or chores				
	5	difficulty organizing tasks or activities				
	6	avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)				
	7	loses things such as toys, school assignments, pencils, books, and tools				
	8	easily distracted by extraneous stimuli				
	9	forgetful in daily activities				
Hyperactivity	10	fidgets with hands or feet or squirms in seat				
	11	leaves seat in classroom or other settings in which remaining seated is expected				
	12	runs about or climbs excessively in inappropriate situations				
	13	difficulty playing or engaging in leisure activities quietly				
	14	"on the go" or acts as if "driven by a motor"				
	15	talks excessively				
Impulsivity	16	blurts out answers before questions have been completed				
	17	has difficulty awaiting turns				
	18	interrupts or intrudes on others by, for example, butting into conversations or games				
Learning Difficulties	19	Reading				
	20	Comprehension				
	21	Understanding instructions				
	22	Spelling problems				
	23	Writing difficulties				
	24	Problems in arithmetic				

Any medication prescribed? yes/no what kind_____

At what time_____ _____mg per day

Please add more details as necessary

The rating is done by the teacher or caregiver, from “not at all or none” (0) to “very much” (3).

Norms were based on a sample of 8000+ children and adolescents, males and females, 3-17 years old. Standardized data were based on the means and standard deviations for groups of children with ADHD and children without psychological problems.

Appendix 5:

Attention questionnaire (Adapted from Barkley, 1995)

Name_____ age_____ male/female name of teacher_____ date_____

Please put an x in the sentence that is most appropriate for the child according to severity of the problem:

		Not true 0	**sometimes true 1**	**Very true 2**	
1	Difficulty finishing chores he/she has started				❖ o
2	Cannot concentrate, cannot pay attention for a long time				❖ o
3	Cannot sit still, restless or hyperactive				✓ o
4	Moving nervously				✓ o
5	Daydreaming or getting lost in his/her thoughts				❖ o
6	Impulsive or acts without thinking				✓ o
7	Having difficulty following instructions				❖ o
8	Talks out of turn				✓ o
9	Has a messy table, or his work is out of order				❖ o
10	Not listening, very easily distracted				❖ o
11	Talks too much				✓ o
12	Difficulty performing his/her chores				❖ o

Please add more information as needed_____

Thank you.

- ❖ inattention

- ✓ overactivity